DECEMBER • 1953
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

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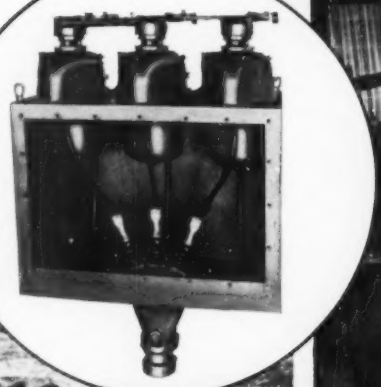
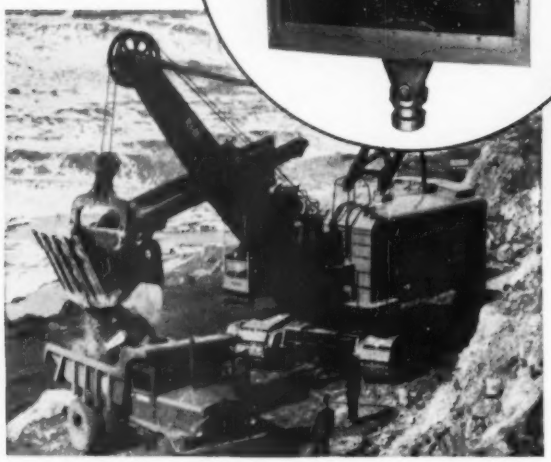
AMPLE PARKING *area lighting is feature of shopping center design.*

ELECTRICAL *distribution stepped up on long range plan at Jenkintown, Pa. plant.*

A McGRAW-HILL PUBLICATION | 53RD YEAR



3-PHASE METAL ENCLOSED oil fuse cutout assembly, with cover panel removed.



UNIVERSAL INTERNATIONAL PICTURES CORP. studios at Universal City, Calif., here shown filming "All American" starring Tony Curtis, use both single-phase and 3-phase G-E oil fuse cutout assemblies in their Editorial Building vault.

P & H ELECTRIC SHOVELS (manufactured by Harnischfeger Corp., Milwaukee, Wis.) are equipped with G-E oil fuse cutout assemblies for short-circuit protection of electrical equipment where greater safety, minimum space and ease of operation are so essential.

Electric shovel or movie studio . . . both use G-E oil fuse cutouts for low-cost switching

Metal-enclosed assemblies, gang-operated, provide maximum personnel safety, neat appearance and service dependability

Wherever the job of overcurrent protection is coupled with the need for some load switching, General Electric oil fuse cutout assemblies combine both functions with greater safety of operation, long life and low cost. Their high interrupting rating (up to 11,000 rms amperes), long contact life, and quiet, almost noiseless operation, make them the ideal fusing device where installations must be made indoors or in working areas. They may be wall or direct-to-equipment mounted.

Metal-enclosed assemblies of G-E oil fuse cutouts, either single or three-phase, provide a neat appearance —all wiring and electrical connections completely enclosed in a grounded steel cabinet, factory assembled for easy, fast installation. Just connect the unit, fill the cutouts with oil, and insert fuse link or disconnect blade. Such cutouts can also be furnished for mounting on steel skids which make them ideal for portable protection in mines, oil fields, naval yards, etc.

G-E oil fuse cutout features include:

- **No expansion chamber required for full interrupting capacity**
- **Simple re-fusing, even on gang-operated assemblies. Pre-formed fuse links easily slip into place**
- **Silver-plated, heavy forged copper contacts with special arcing tips . . . minimize wear**
- **Leads brought into cutout housing above oil level—no gasketed joints under oil pressure**

G-E oil fuse cutout assemblies are ideal for utility, industrial, commercial and institutional use within the range of 2400 through 7200 volts.

For full details, contact your nearest G-E Sales Representative or write for Bulletin GEC-863 to General Electric Co., Schenectady 5, N. Y. 433-2

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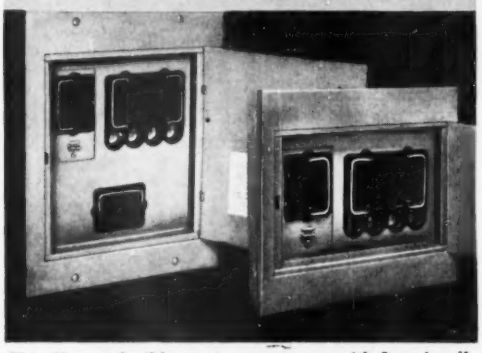


This 60-amp fusible equipment comes with 3 or 4 pull-outs and 4, 6 or 8 branch circuits, in series or parallel. Handles almost any load combination. Panels have dead front construction, are finished in attractive baked-on grey Melamine. Famous Murray quality throughout

Everything: Main, Lighting & Appliance, and Power circuits—complete in one compact box. Everything goes up at one time. Note special sealable compartment containing one pullout—ideal for separate rate off-peak water heating. Barrier removable when not required

. . . helps you meet increased loads at decreased costs!

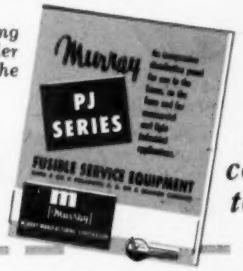
The attractive, low-cost PJ line is designed to help you handle increased loads on home, farm and commercial jobs with a minimum of equipment. With only six basic panels you get full-line versatility for almost any combination of light, appliance and power circuits. Minimum-stock line also means easier ordering and stocking for you.

. . . saves you more time and money on installation!

Putting up PJ panels is clean, fast work with installation time cut to the bone. There are plenty of clean-cut, easy-to-remove KO's just where you want them. Plenty of knuckle room, too. And no wire fumbling—you'll find high quality solderless connectors on all terminals conveniently located. Surface hook-on cover saves extra time.

In every way, Murray PJ panels are ideal for low-cost installations. Your Murray wholesaler has them now. Lay in a supply today and be ready for any job that comes along.

For complete details and wiring diagrams, ask your wholesaler for Bulletin 231, or send the coupon in.



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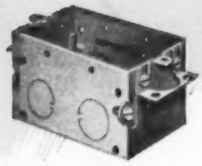

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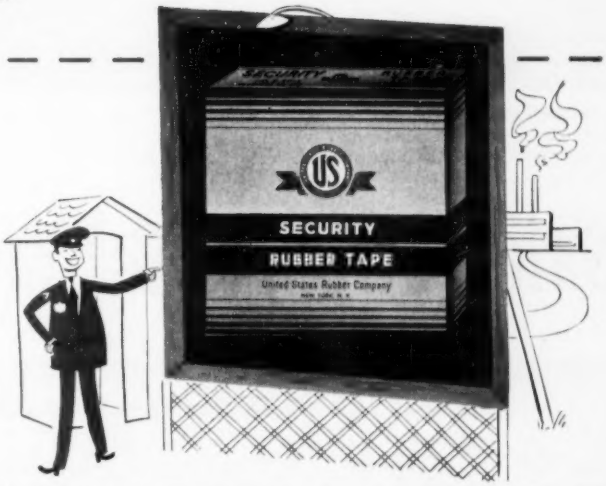

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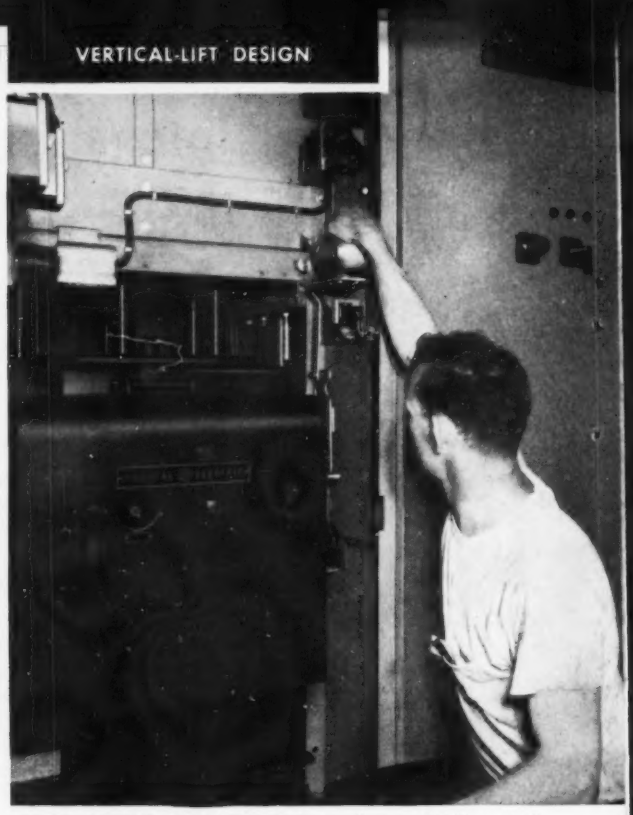
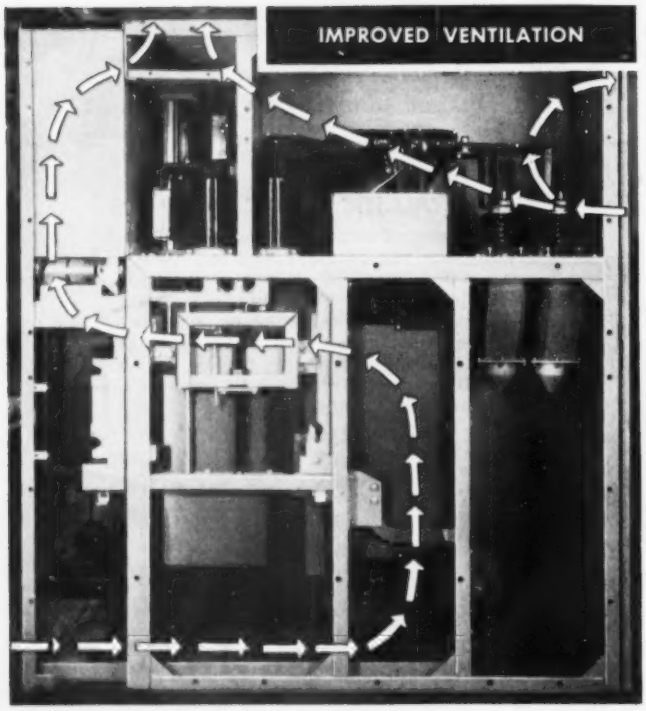
GENERAL ELECTRIC'S" SELF-X" self-extinguishing insulation is used here (arrows) as flame-retardant insulating barriers for arc chutes of magne-blast breaker in improved G-E metal-clad switchgear.

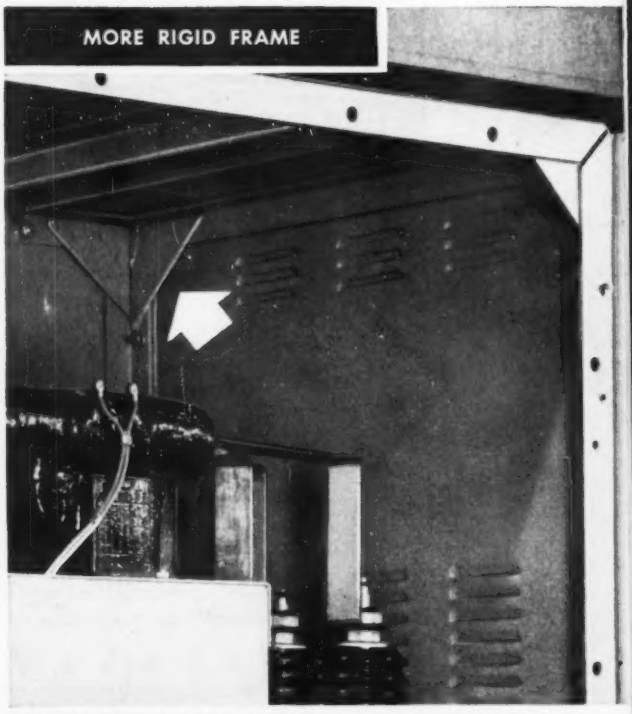


FASTER-ACTING MECHANISM, integral part of G-E vertical-lift design, raises, lowers breaker in 30 seconds. Vertical-lift isolates breaker—enables you to *SEE* disconnect.

Safer, stronger G-E metal-clad switchgear



NATURAL AIR DRAFT follows path of arrows, constantly ventilating entire unit. Vertical screened openings at top keep out foreign matter. Bus compartment is totally enclosed.



COMPLETELY WELDED FRAME gives rigid structure with gusseted corners (arrow). Sturdiness makes frame one solid unit to withstand jolts of cross-country shipment.

MAGNE-BLAST BREAKERS are easily, safely removed for inspection and maintenance from G-E improved metal-clad switchgear installed at Quaker Rubber Corp., Philadelphia. New, completely enclosed metal-clad 13.2-kv lineup, replacing old stationary circuit breakers, consists of incoming main line breaker, power company metering compartment, and four feeder circuit breakers.

assures reliable power at Quaker Rubber

New design features of 13.2-kv metal-clad give Philadelphia plant up-to-date protection for its expanded, modernized distribution system

When Quaker Rubber Corporation in Philadelphia installed a new power distribution system in its plant, engineers replaced stationary circuit breakers with General Electric's new, improved metal-clad switchgear.

Basic design of G-E metal-clad equipment remains essentially the same, fully meeting all industry standards. But the completely enclosed, pre-engineered units feature a number of G-E design advances—all reasons why Quaker Rubber selected G-E switchgear above other makes. For example . . .

G.E.'s new flame-retardant insulation, "SELF-X", with self-extinguishing properties that smother fire occuring under abnormal conditions, permits quick access for inspection and maintenance after localized damage.

Faster-acting breaker-elevating mechanism, part of G-E vertical-lift design, raises, lowers breaker in 30 seconds. Vertical-lift itself gives clear view of disconnected breaker.

Improved ventilation system for each complete switchgear unit cools all components with natural air drafts.

More rigid, all-welded frame provides sturdier construction—withstands shipment stresses better.

Advanced magne-blast breaker design gives easy access to operating mechanism and control relays—simplified contact design means longer breaker life.

For details on these design improvements in G-E metal-clad switchgear, call your nearest G-E sales representative. Or write for the booklet, GEA-5664-A, Sect. 874-5, General Electric Company, Schenectady 5, N. Y.

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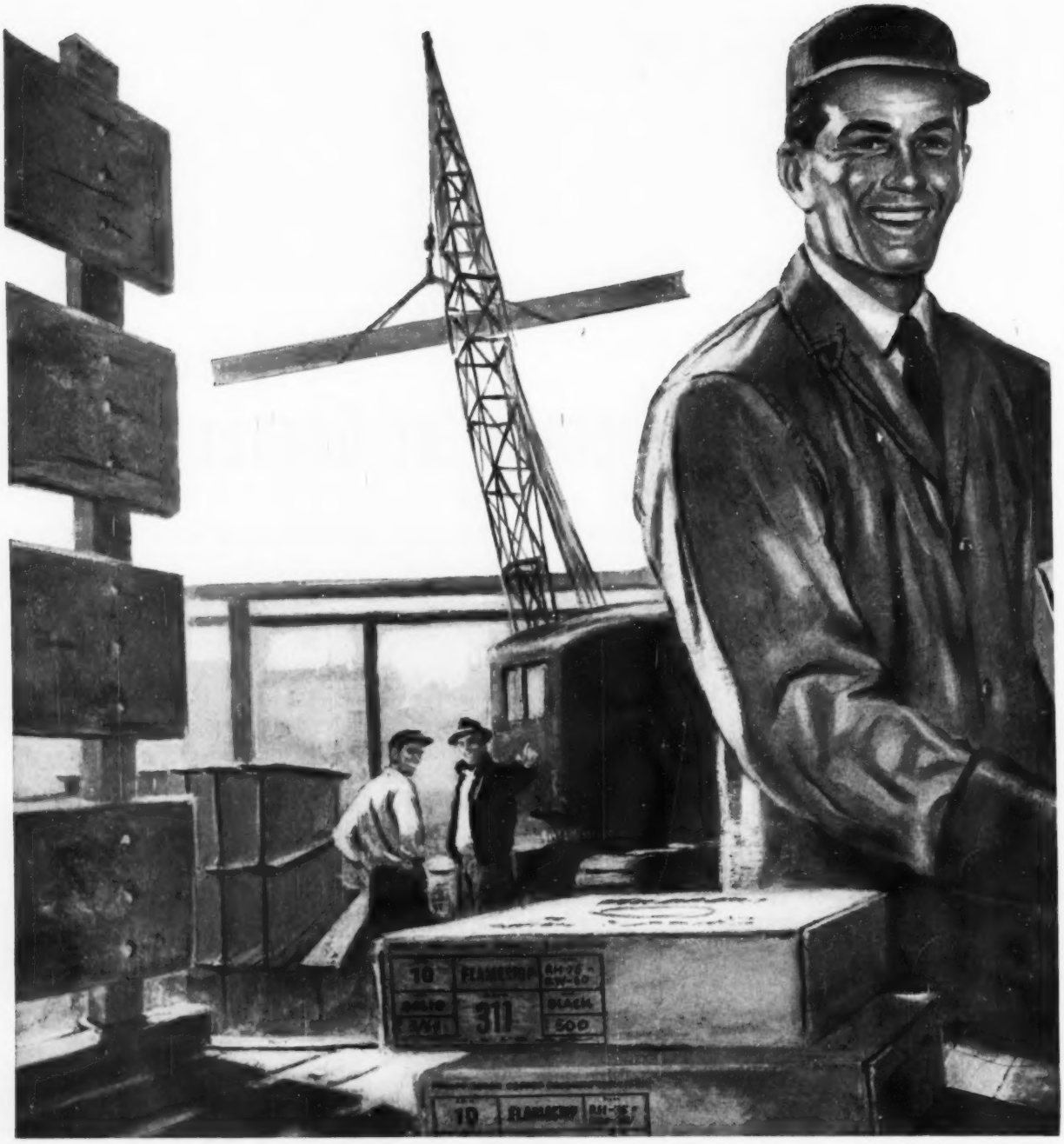

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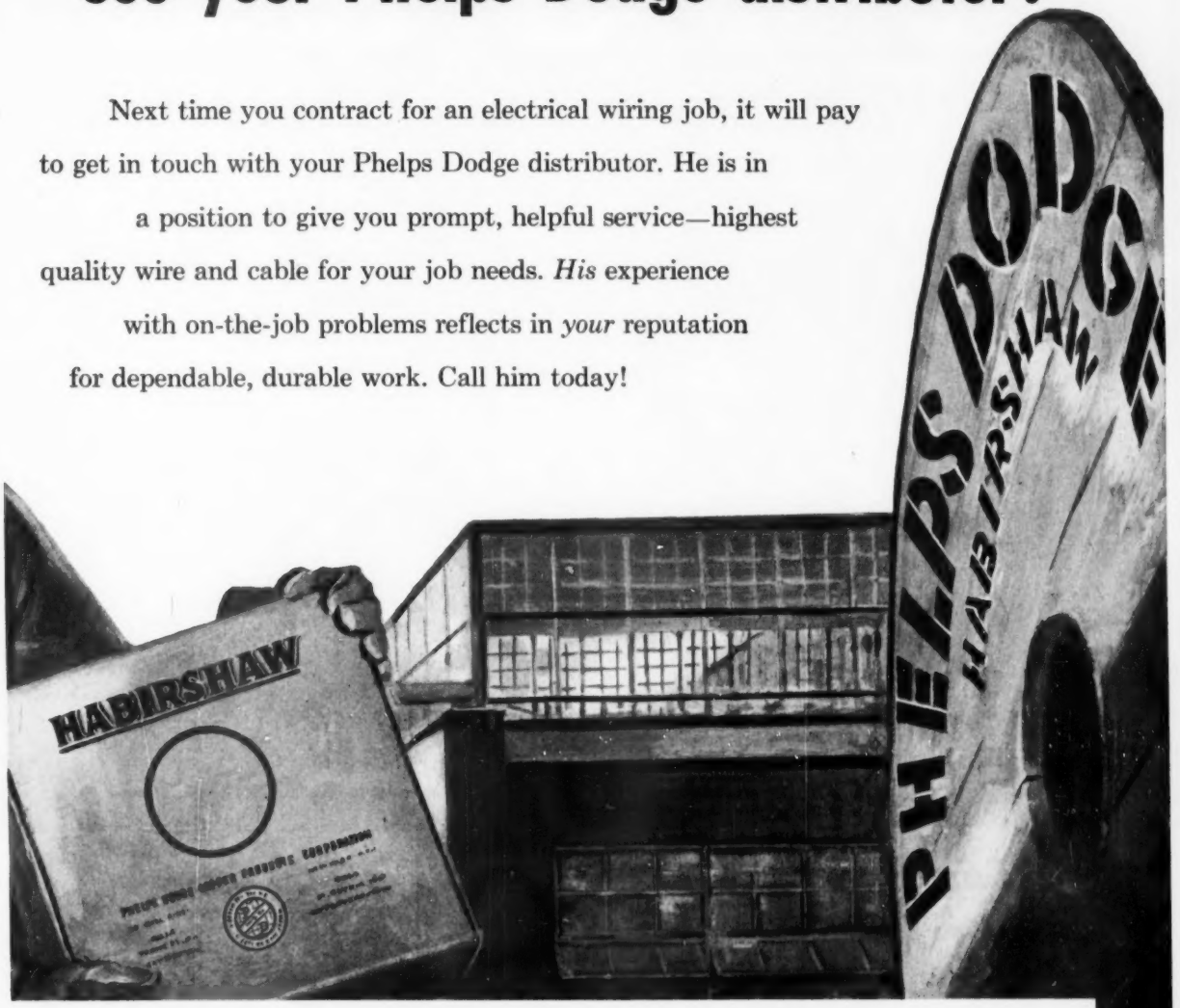

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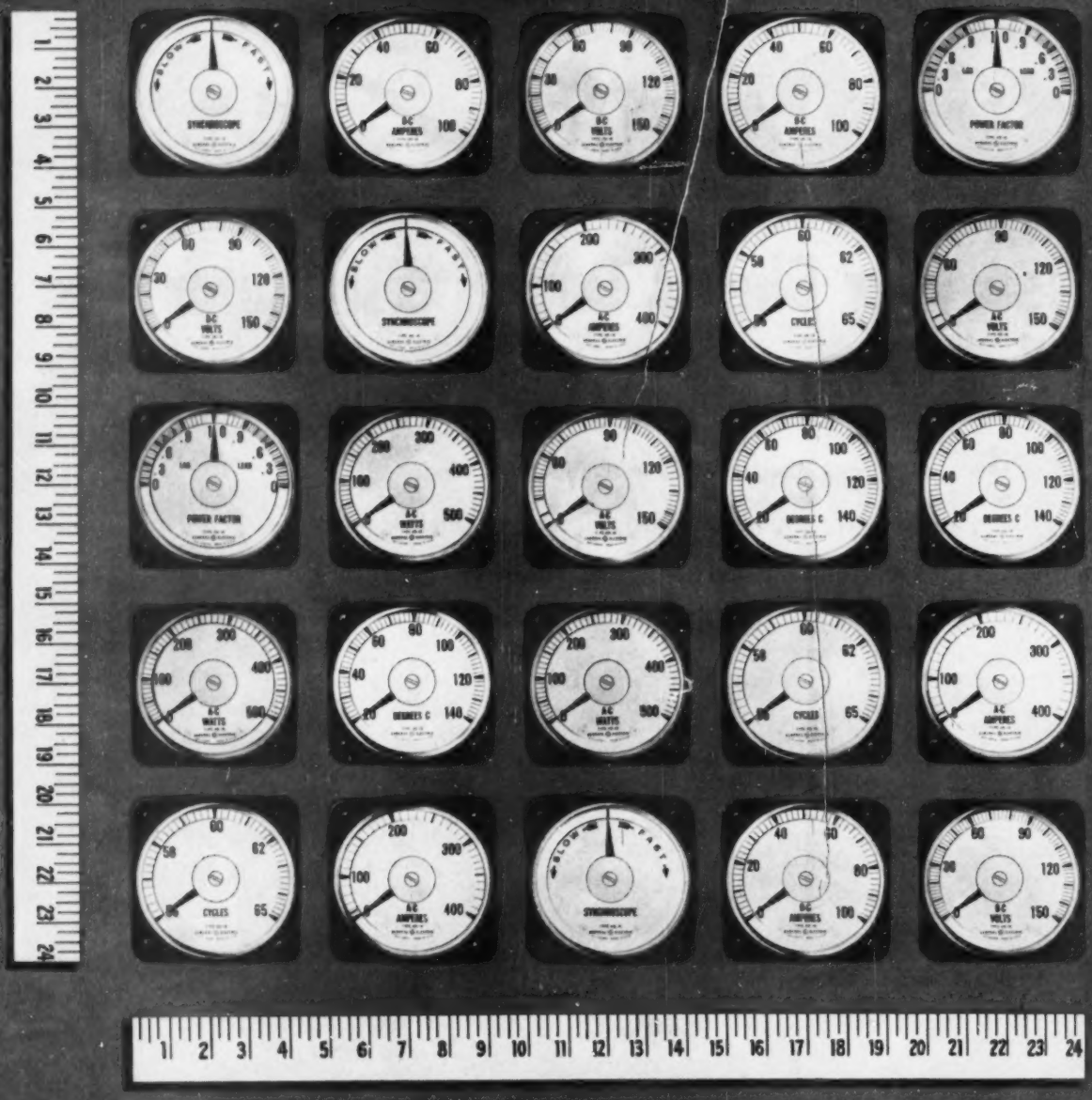

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FOR DETAILS, contact your G-E Apparatus Sales Office, or write for Bulletin GEC-218 to Section 602-265, General Electric Company, Schenectady 5, N. Y.

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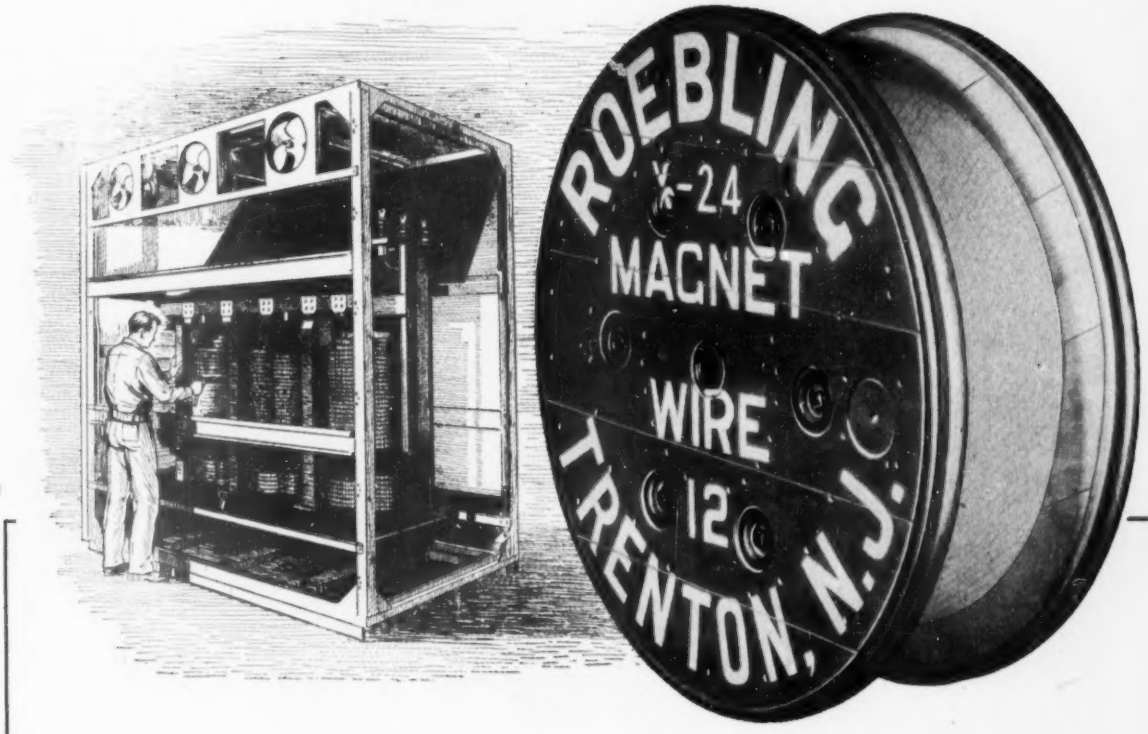

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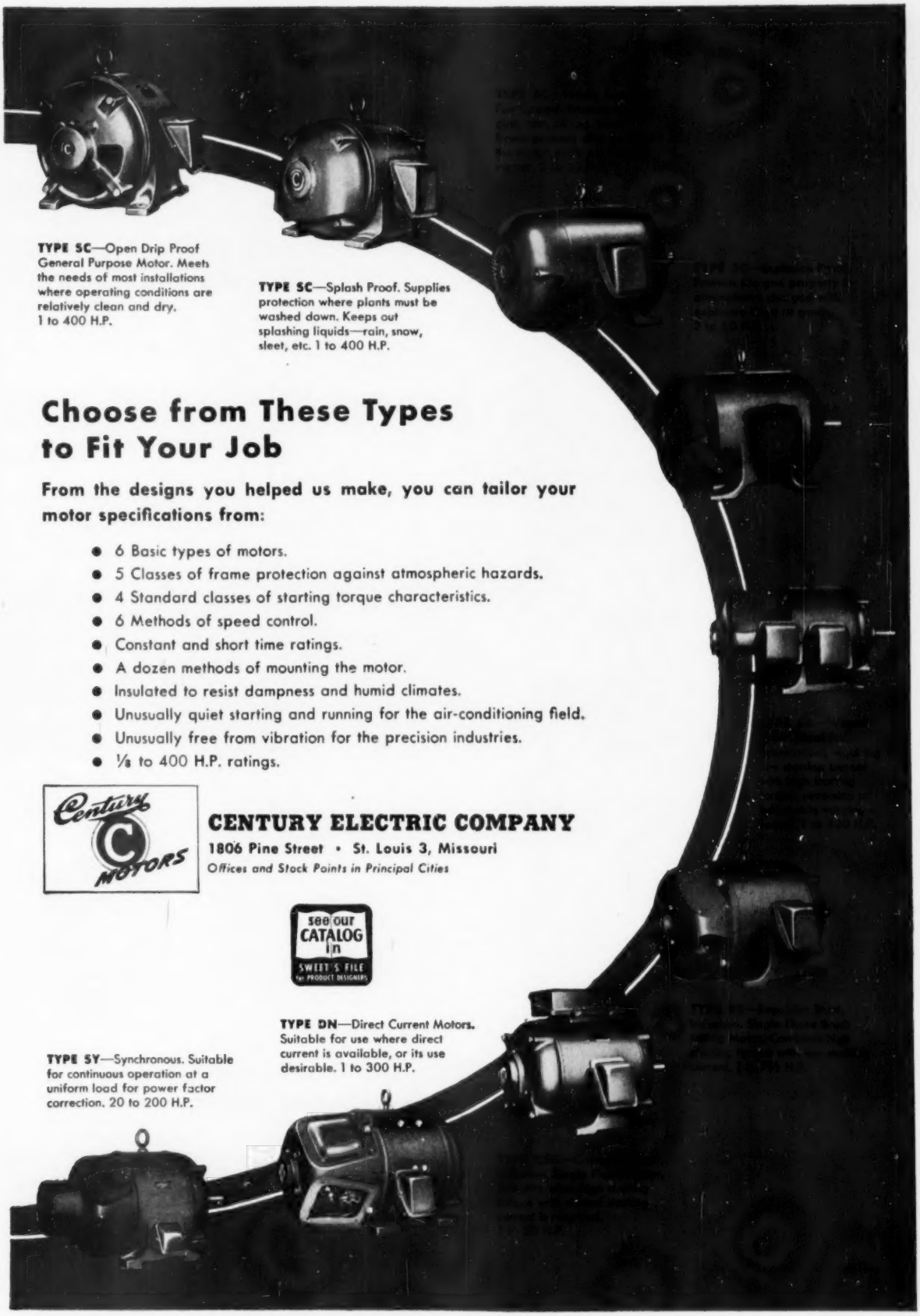

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Protects Wiring

from oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather

SEALTITE* is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned ports.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical industries, and in many outdoor applications. SEALTITE comes in two types:

53200

TYPE UA— UL-approved. Made with flexible galvanized steel core, positive ground and tough outer cover.

NOM. ID (inches)	OUTSIDE DIA. (inches)		APPROX. INSIDE BEND DIA. (inches)	EST. WEIGHT PER FOOT (Pounds)
	Min.	Max.		
⅜	.690	.710	8	.300
½	.820	.840	10	.366
¾	1.030	1.050	15	.482
1	1.290	1.315	18	.877
1¼	1.630	1.660	21	1.165

TYPE EF (Extra flexible)—for machine tools and industrial equipment (Meets J.I.C. requirements)

NOM. ID (inches)	OUTSIDE DIA. (inches)		APPROX. INSIDE BEND DIA. (inches)	EST. WEIGHT PER FOOT (Pounds)
	Min.	Max.		
⅜	.690	.710	5	.243
½	.820	.840	6	.290
¾	1.030	1.050	9	.382
1	1.290	1.315	10	.650
1¼	1.630	1.660	13	.844
1½	1.870	1.900	15	1.220
2	2.335	2.375	17	1.580

Commercial tolerances apply on above figures.

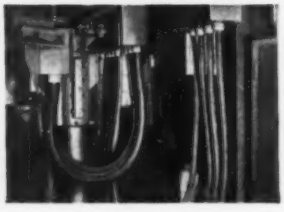
ELECTRICAL SUPPLY HOUSES stock both types. Buy it in long random lengths as shown; then cut without waste. Or ask your supplier to cut the length you need. Standard fittings are available from jobbers' stocks. Write for Bulletin UA-530. *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.*

*Trade Mark

SEALTITE an ANACONDA® Product
flexible, liquid-tight electrical conduit

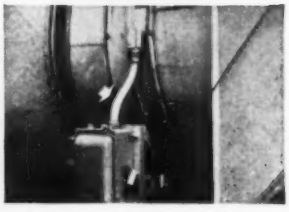
FOR WET SPOTS

MOVING CONNECTIONS



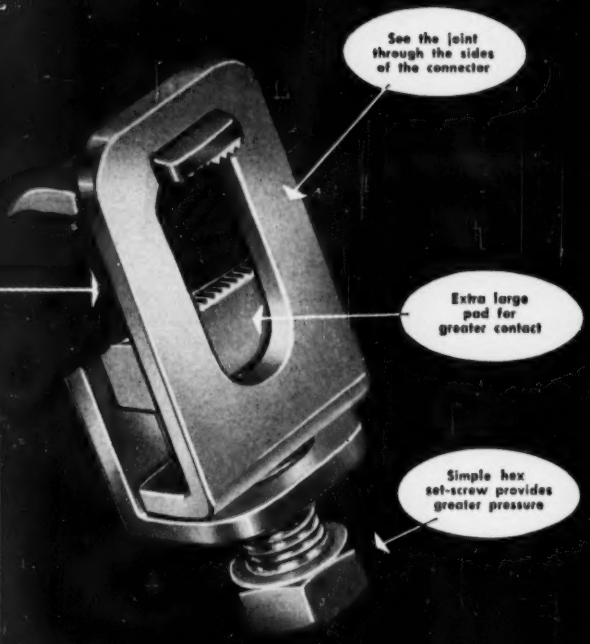
OUTDOORS

MISALIGNMENT



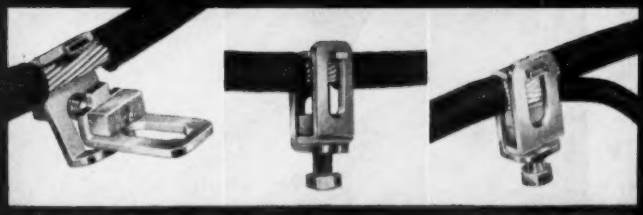
PRESENTING THE NEW

IDEAL Tap Connector


See the joint through the sides of the connector
Extra large pad for greater contact
Simple hex set-screw provides greater pressure

The First Major Improvement in Tap Connectors to Offer All These Advantages

Stronger Mechanically!
Easier to Use! Costs Less!
Only 3 Sizes Needed! Made of
Cold-Worked Steel, with Heavy Hot-Zinc Dip



The IDEAL Tap Connector is entirely new . . . designed and built to give you stronger tap connections, with less work and at lower cost per unit.

Unique Design . . . Takes fullest advantage of the greater strength of cold-worked steel, hot-zinc dipped, to make tightest connections without distortion or "bowing" of the connector.

Greater Contact Area . . . Extra large pad and stirrup distribute pressure and reduce deformation or cold-flow of wire — make low-resistance connection.

Greater Pressure . . . up to 1½ times as great as ordinary connectors.

THIS COMBINATION OF EXTRA MECHANICAL STRENGTH, GREATER CONTACT AREA AND GREATER PRESSURE ELIMINATES ALL CHANCE FOR WIRES TO WORK LOOSE, WITH RESULTING POOR CONTACTS AND POSSIBLE "BURN-OUTS".

Easier to Use . . . No parts to come loose or fall off, even in models using conductor spacers. Nothing but a wrench is needed – and you can actually see the joint from all sides.

1. Place IDEAL Tap Connector on main **2.** Close Connector **3.** Insert Tap and Tighten

THREE SIZES for all combinations from two No. 1 wires to 1 No. 10 and one No. 12 or one No. 8 and one No. 14.

WITH SPACER BARS for copper-to-aluminum, aluminum-to-steel or copper-to-steel.

WITHOUT SPACER BARS for copper-to-copper or aluminum-to-aluminum.

Costs Less . . . Lower priced than other connectors for practically every combination.

Easier to Stock . . . Three sizes handle a range of combinations requiring as many as seven sizes of ordinary connectors.

Versatile . . . Use them for street taps — service drops to service entrance — dead end loops — T-taps — transformer connections — machine tool connections — grounding connections, etc.

IDEAL

MAIL COUPON FOR FULL DATA
— How you can save money and have better tap connections.
Sold Through Leading Distributors

IDEAL INDUSTRIES, Inc., 1041 Park Avenue, Sycamore, Illinois

Please see that we get information on IDEAL'S new Tap Connector.

Name_____
Company_____
Address_____
City_____ Zone_____ State_____

"Cut costs with Buckeye Conduit-- it bends so uniformly!"

MIDWEST CONTRACTOR TALKS ABOUT CONDUIT: "When I pay good money for workers, I want the utmost in production. That's why I use Youngstown "Buckeye" conduit. My men bend and install "Buckeye" in short order without wasting precious time."

ELECTRICAL WHOLESALER DESCRIBES BUCKEYE CONDUIT: "My customers tell me that bending "Buckeye" evenly takes a minimum of time and effort. This enables them to cut down on overtime work. As far as I'm concerned, I recommend "Buckeye" highly."

Youngstown makes rigid steel conduit from start to finish. This enables Youngstown to control the complete manufacturing process which insures that each length of "Buckeye" Conduit is made of topgrade steel. Since only high quality steel makes for easy bending, it's no wonder Youngstown "Buckeye" conduit is favored by electrical men.

Shipments of "Buckeye" rigid steel conduit are now being made from our conduit mills at Indiana Harbor and Youngstown.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

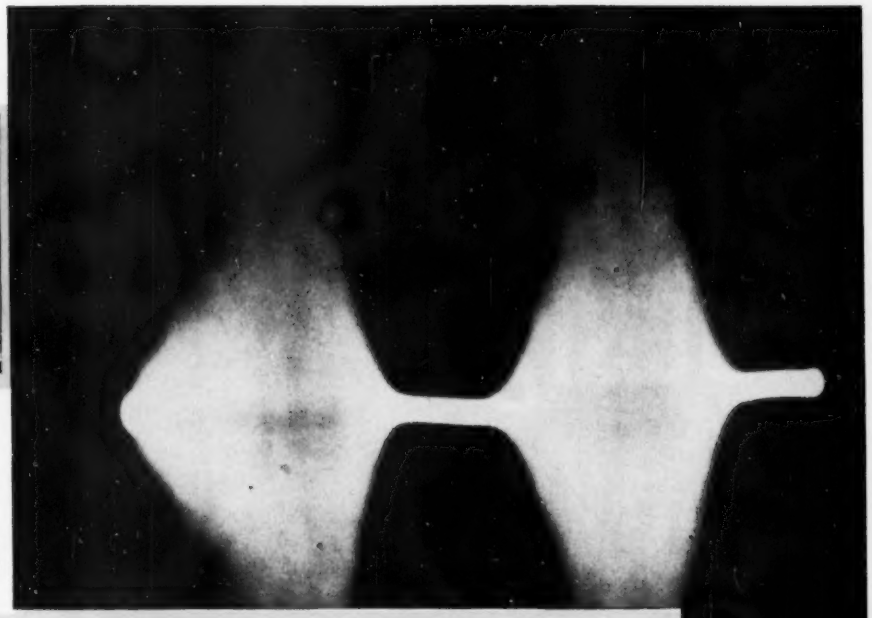
Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

COLD FINISHED CARBON AND ALLOY BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES

Specially designed ionization detector for routine factory use measures corona level of all-insulated cables rated at 3000 volts or over.



Why Rome's corona level testing assures cable dependability

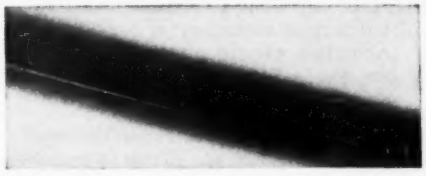
The picture above means trouble. It is an oscilloscope trace of internal ionization in an insulated cable.

Ionization is caused by the electrical break-down of air in pockets within the insulation, or especially where it has not been firmly bonded to the conductor surface or shield. Should this ionization occur at a value below the operating voltage of the cable, several destructive electrical effects may occur such as possible ozone cutting, reduced dielectrical strength, and a substantial increase in dielectric losses. Any of these hazards could result in early failure or reduce the efficient performance life of the cable.

Ionization is particularly dangerous because it cannot be detected by the ordinary visual, physical and electrical testing methods usually applied to cable.

So, to prevent guesswork, to assure you of maximum protection against ionization, *every foot of Rome insulated cable, rated at 3000 volts or over, is thoroughly tested by a specially designed ionization detector.* This instrument accurately measures the corona level of the entire cable. Unless the ionization voltage exceeds the intended operating voltage of the cable, the cable is rejected.

This is one more extra step in Rome Cable's standard manufacturing procedure that assures dependability. This completely new *NONDESTRUCTIVE* method of testing was developed by Rome Cable engineers and was first described in AIEE paper 48-198, "The Measurement and Investigation of Ionization Level of Rubber Insulated Cables," presented in August, 1948.



This X-ray reveals loose insulation—a major cause of ionization.

500,000 CM stranded single conductor RoZone insulated, shielded, RoPrene sheathed power cable . . . 15,000 volts, grounded neutral.

ROME CABLE Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

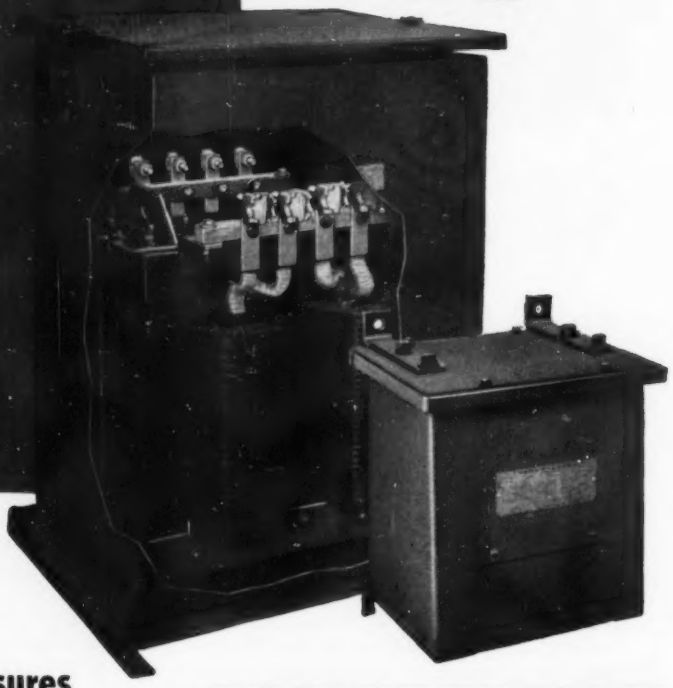
ROME CABLE CORPORATION, Dpt. EC-12, Rome, N. Y.
Please send me a copy of ..... AIEE paper 48-198
..... Rome Power and Control Cable Catalog.
Name.....
Company.....
Address.....
City.....Zone.....State.....

Compact Design Saves Time

ALLIS-CHALMERS

Dry-Type

TRANSFORMERS



- ★ **Simplifies Installation**
- ★ **Makes Handling Easy**
- ★ **Eliminates Vaults or Enclosures**

It's easy to install an Allis-Chalmers dry-type transformer. Compact design results in a small, light weight transformer that can be easily handled.

There is plenty of work space in the big, roomy wiring compartment, too, for connecting system cables. Conduit knockouts are provided. Hookup time is reduced to minutes through the use of solderless clamp-type connectors on sizes 15 to 50 kva, inclusive, single phase, and sizes 45 to 112½ kva, inclusive, three phase.

Get These Benefits

All-welded case gives complete protection. No additional enclosures or vaults are required. Surface finish is resistant to corrosion by acids, vapors or moisture. Surface is Spra-Bonderized. Three coats of alkyd-resinous paint are then separately baked on.

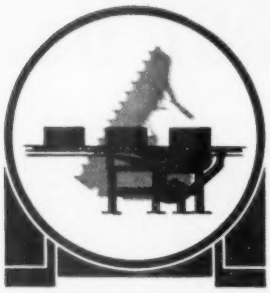
Let Allis-Chalmers Class "B" dry-type transformers furnish full voltage at the load. To get complete information, contact your nearby Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4034

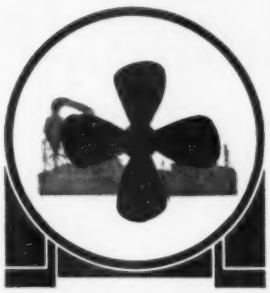
DESIGN ARRANGEMENTS

KVA SIZES		MOUNTING ARRANGEMENT	TERMINATIONS
SINGLE PHASE	THREE PHASE		
3 5 10	9 15	WALL MOUNTING LUGS	BOTTOM TERMINAL COMPARTMENT WITH REMOVABLE FRONT PLATE
15 25	30	WALL MOUNTING LUGS AND BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER
37½ 50 75 100 167	75 112½ 150 225 300	BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER

ALLIS-CHALMERS



Material Conveying



Ventilating

When space is a problem, specify Fairbanks-Morse Axial Air Gap Motors.

Electric Motors

for every industry

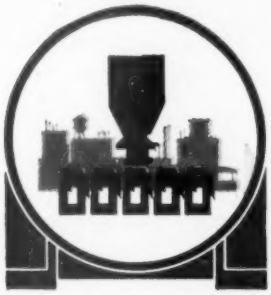
When you need electric motors . . . in any rating, or frame type . . . one or a thousand . . . *always* look for the Fairbanks-Morse Seal. For over 120 years it has stood for the finest in manufacturing integrity to *all* industry.

Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE

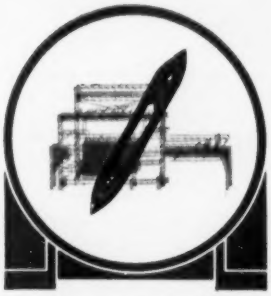
a name worth remembering when you want the best

ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • RAIL CARS • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS



Food Processing

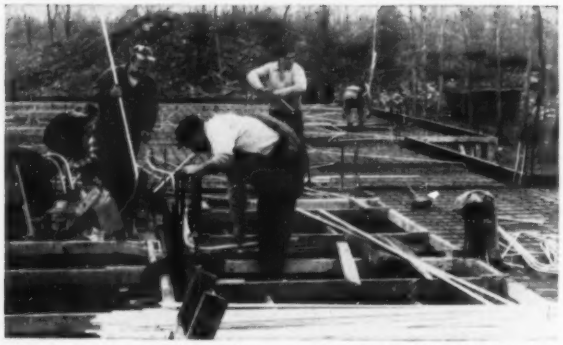
Metal Cutting



Textile Manufacturing

Bridgeport, Conn., Project Uses

Delays on a project like Bridgeport can be costly. Penalties are high. Using ELECTRUNITE E.M.T., which can be installed easily and quickly, helps keep buildings on schedule.

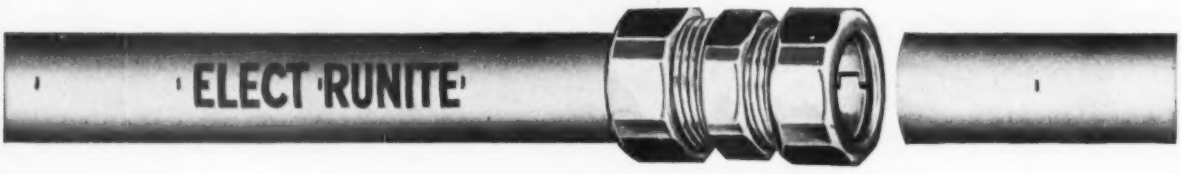


There's no time wasted threading . . . either on the job, or in the shop . . . when you use Republic ELECTRUNITE E.M.T. Instead, journeymen make tight joints using threadless connectors and couplings.

ELECTRUNITE E.M.T. is easier to install in crowded quarters because there are no lines to turn. Advantages are many on concrete jobs like this one.

In bad weather, bends can be easily pre-fabricated in the shop. On good days, lightweight ELECTRUNITE E.M.T. can be bent right on the job, using the Republic bender. You can get valuable hints from "The Bending System." Write for your copy.

On good days, bending can be done quickly, and accurately on the deck with "Inch-Marked®" ELECTRUNITE E.M.T. using the Republic bender. All it takes to make tight joints is two wrenches. No threading.



Over 500,000 feet of Republic

ELECTRUNITE E·M·T·

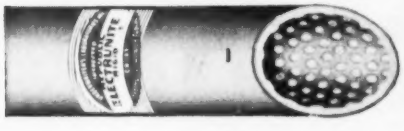
Beardsley Park Terrace Housing Project, Bridgeport, Conn.
Architects: Lindsay & Johnson, Bridgeport.
Electrical Engineer: John Shallenberger, Bridgeport.
General Contractor: E & F Construction Co., Bridgeport.
Electrical Contractor: Park City Electric Co., Bridgeport.

● When a contractor uses that much Republic ELECTRUNITE® E.M.T. you can be sure he has good reasons. One of them is the fact that it goes in easily and quickly, helps keep building schedules on time. And where penalties are high, that's especially important.

Journeymen like to work with ELECTRUNITE E.M.T. It's lightweight, easy to handle. Cuts easily, too, and accurately, because it's "Inch-Marked®". And smooth, accurate bends can be made with the Republic bender, when instructions are followed.

Republic ELECTRUNITE E.M.T. is approved by the National Electrical Code for exposed, concealed and concrete slab construction. And by Underwriter's Laboratories. Get all the facts and you'll get this easy-to-install electrical raceway for your next job. It pays. For more facts, write for free booklet.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
212 EAST 131ST STREET • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N.Y.



REPUBLIC STEEL

Republic
ELECTRUNITE E.M.T.

☑ CHECK General Cable "POWER TWINS"

Modern, All-purpose Plant and Equipment Wiring

✓ **VARNISHED CAMBRIC OR RUBBER INSULATED CABLES WITH INTERLOCKING ARMOR**

✓ **SAFETY m. i. WIRING SYSTEMS (Pyrotenax®)**

On any new plant construction job, the General Cable "Power Twins" provide today's modern, flexible wiring team for all power, lighting, control and machine tool applications. Can easily be shaped on the job. Especially economical and adaptable in close areas under and around beams and pillars.

- **VARNISHED CAMBRIC** or rubber insulated with interlocked galvanized steel, bronze, or aluminum armor. Rubber insulated types are available in THERMAX W (heat and moisture resistant) and GENCORONE (corona resistant) insulations.

- **SAFETY m.i. WIRING SYSTEMS (Pyrotenax®) Type m.i. 1953 Code Approved**
  A General Cable exclusive, offering a dramatic new advance in electrical wiring for all applications up to 600v. where heat, vapors, moisture, aging are of particular concern. Ideal for low voltage, lighting, power, control, machine tool and equipment uses. Lower installation costs, rigid yet flexible, and immune to age deterioration due to its "all mineral construction."

Your nearest General Cable representative can show you the many advantages of wiring with the "Power Twins." A call will bring him quickly, or write Headquarters.

Other General Cable Wires and Cables for Plant Construction include:

Asbestos Varnished Cambric and all Asbestos Power and Control Cables

Super Service Portable Cords and Cables for power, lighting, control and machine tool leads to bussways, small tools in plants, etc.

Super Service and low-cost Welding Cables

SUPERSHEATH "TRIPLETS"

- Type USE—Thermax W insulation with Neoprene Jacket for direct earth burial service entrance.
- Type RHWN—Thermax W insulation with Neoprene Jacket for aerial, duct, conduit and direct earth burial applications.
- Type GN—Gencorone (Corona resistant) insulation with Neoprene Jacket for medium and high voltage applications—all types.

Rubber and Plastic power and control cables, Rubber or Gencorone (Corona resistant) or Plastic insulated with braided, leaded and armored finish. . . . and other types.

GENERAL CABLE
CORPORATION

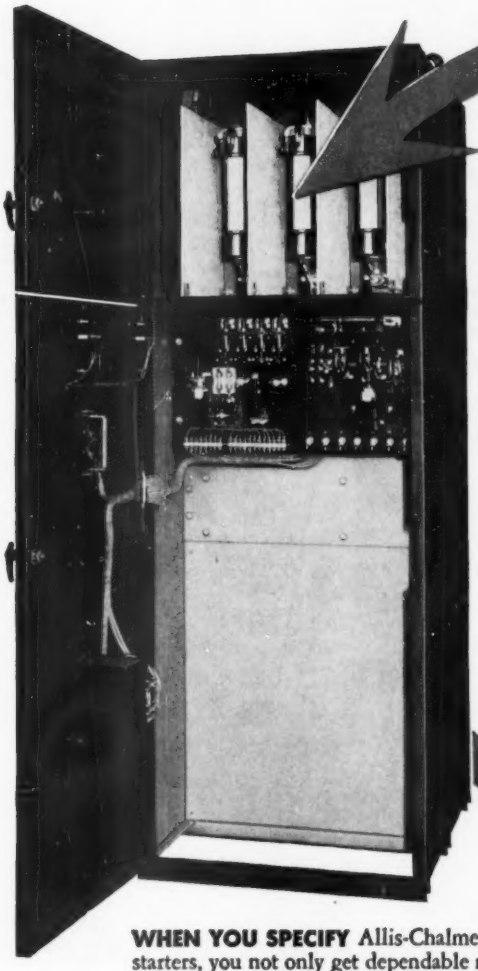
Executive Offices: 420 Lexington Avenue, New York 17, N. Y. • Sales Offices in Principal Cities of the United States

ALLIS-CHALMERS

Type H Starters

FOR 2300 TO 5000 VOLT MOTORS

Give YOU Full Protection



SHORT CIRCUIT PROTECTION

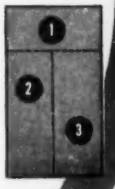
Current-limiting fuse clears short circuit in less than ½ cycle . . . long before the short has had time to harm contactor or motor. Blown fuse emits no gas, flame nor vapor, discharges no metal. Flashover caused by ionized vapor is eliminated.

OVERLOAD PROTECTION

Type 194 thermal overload relay automatically adjusts for ambient temperatures — trips only on motor overload. Prevents unnecessary motor outages. Allows use of maximum capacity, but prevents dangerous motor overloads. Can be adjusted to plus or minus 20% of rated current.

PERSONNEL PROTECTION

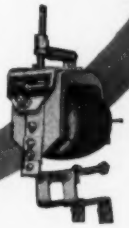
The steel cubicle is divided into three compartments for maximum personnel protection. 1 — Upper front compartment encloses disconnect type fuses. 2 — Lower front compartment houses low voltage control devices. 3 — Rear compartment contains high voltage equipment, contactors, buses, intrument transformers, etc.



Side View of Cubicle

TIME DELAY UNDERVOLTAGE PROTECTION

Should an undervoltage occur, the line contactor opens. During a predetermined period, relay remains closed to permit restarting of motors when power is restored.

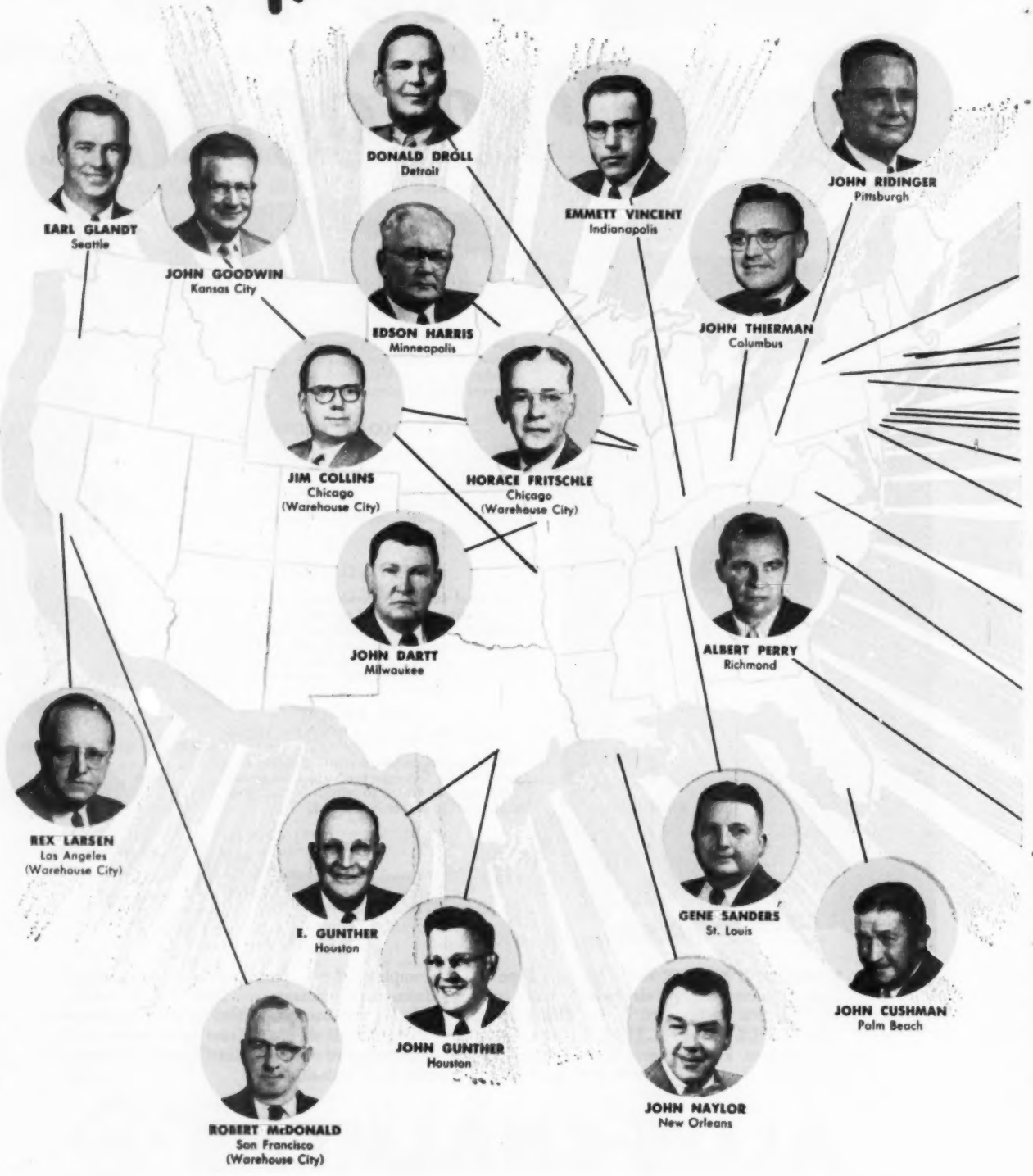


WHEN YOU SPECIFY Allis-Chalmers Type H starters, you not only get dependable motor control, but you are assured of an all-important "plus"— FULL PROTECTION for man, motor and machine. Positive protection as engineered into Type H starters permits men to work in complete safety... protects motors and machines from costly damage . . . lengthens equipment life . . . increases production by reducing down-time. Get all the facts from your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3982

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

THESE 31 *Triangle* REPRESENTATIVES



ALL HAVE THE SAME MIDDLE NAME-

Service

EDWARD COOK, JR.
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JAMES SLATER
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ROBERT DUCKWITZ
Philadelphia

JAMES SWAN
Babylon

BRUCE JOHNSON
New Brunswick

AL WALKER
New Brunswick

EUGENE CROSS
Philadelphia

PAUL KIDDER
Baltimore

JOHN CUSHMAN, JR.
Charlotte
(Warehouse City)

MICHAEL WELCH
Atlanta

These Triangle Sales Representatives have a responsibility to you. They all are dedicated to one aim—to serve you better, quicker and in a more friendly way than you ever thought possible. Cooperation, sincerity and honesty come first on their list of "musts."

These men are backed by a manufacturing organization that has grown, since 1916, from a one story building to an imposing array of four large factories. Starting as a manufacturer of Armored Cable and Flexible Steel Conduit, Triangle today is one of the foremost manufacturers of electrical wire, cable and conduit. In addition to the electrical field, Triangle is now producing plastic pipe, brass and copper tube for the plumbing and heating industry, plus numerous other applications. We at Triangle believe the contributing factors to this growth have been the extra quality of our service and products along with our 100% distributor policy. Service, coupled with our directive to our employees that our products *must be right*, have been the keystones of our business policies.

If you distribute, buy, specify or install wire, cable, conduit, plastic pipe or brass and copper tube, it will pay you to ask for TRIANGLE.

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

Manufacturers of arteries for **electricity, liquids and gases.**

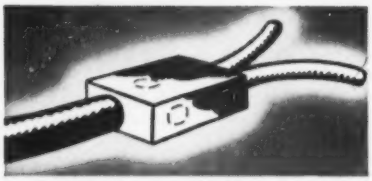
Wire • Cable • Conduit • Plastic Pipe • Brass and Copper Tube

PLANTS—NEW BRUNSWICK, N. J.:
Wire and Cable Plant • Rod Mill • Brass and Copper Tube Mill • Plastic Pipe Plant,
MOUNDSVILLE, W. VA.: Conduit Plant

TRIANGLE

It Must Be Right

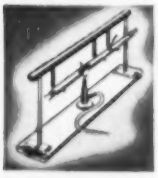
How to get longer life out of your portable cords and cables!



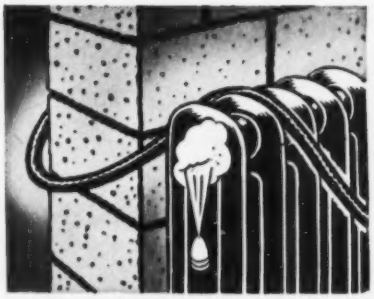
1 **USE** junction or distribution boxes for making multiple power connections in working places.

2 **PROTECT** cables with fuses or circuit breakers of the proper rating for the service. Make sure that circuit breakers will operate properly.

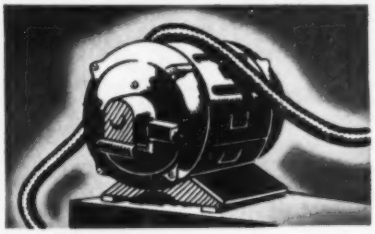
3 **PROTECT** cables from being run over by heavy equipment. Running over the cable a few times may not cause immediate failure, but may do internal damage which will shorten its life. If the cable must be run across an aisle, place boards on either side as one would for a hose. If it is in use for only a short time, it should be thrown over the truck.



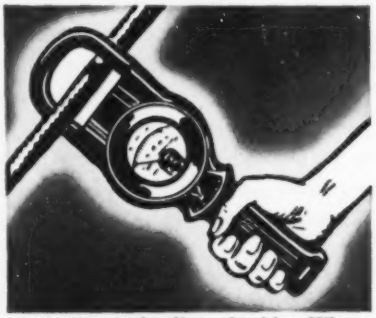
4 **USE** flame-resistant cables wherever possible.



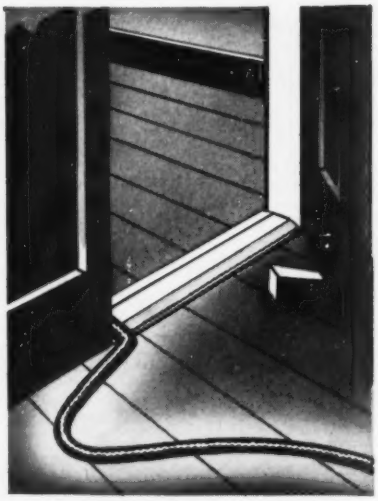
5 **DO NOT** have portable cords and cables running over steam pipes or other heat-transmitting equipment.



6 **KEEP** cables away from sparking motors and high voltage equipment. The ozone generated by sparking commutators attacks rubber jackets, causing cracking.



7 **AVOID** overloading of cables. Where possible, use I.P.C.E.A. recommended current ratings.



8 **AVOID** dragging portable cords around rough edges or sharp corners. Bruises and cuts hasten deterioration of the jacket. Never yank cords to remove kinks or loosen them when caught on a projection.

9 **AVOID** running portable cables on pulleys or drums too small for the size of the cable; observe recommended I.P.C.E.A. minimum diameters.

10 **KEEP** cords away from oils and greases. If they do get into oil, they should be wiped off as soon as possible. Avoid having cords lie in pools of water, chemicals or grease.

11 **BUY** cables that can carry the required current without overloading or overheating. They should be flexible (have sufficiently fine strands) for the intended use.

FOR FREE REPRINTS OF THIS PAGE, WRITE TO ADDRESS BELOW.

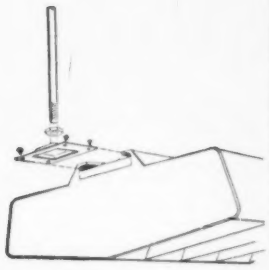
UNITED STATES RUBBER COMPANY

U.S.RUBBER
SERVING THROUGH SCIENCE

Electrical Wire and Cable Department

ROCKEFELLER CENTER • NEW YORK 20, NEW YORK

a beautiful new luminaire with full length luminous plastic side panels — and sliding stem plates to simplify mounting.



No opaque metal frames mar the beauty of the Cavalier's luminous plastic side panels. Yet the construction is sound and sturdy, for inside is a supporting steel frame which also acts as an internal reflector.

But there's more than beauty to recommend this entirely new luminaire. There's a wonderfully ingenious sliding stem plate which can be moved from end to end to support the Cavalier at any point, completely eliminating problems of in-line spacing of mounting points. Together with adjustable ceiling straps and hook-on stems, this new feature greatly simplifies the installer's job.

NOW CONSIDER A FEW OTHER GOOD POINTS:

1 A special low brightness finish on louvers, side reflectors and channels keeps brightness contrasts down.

2 Equipped for Rapid Start or Slimline lamps. Two models, the Cavalier II (two lamps) and the Cavalier IV (four lamps).

3 Louvers are released by press buttons and suspend on chains.

4 Snap-on end plates with each body —no extra set of end plates to be ordered.

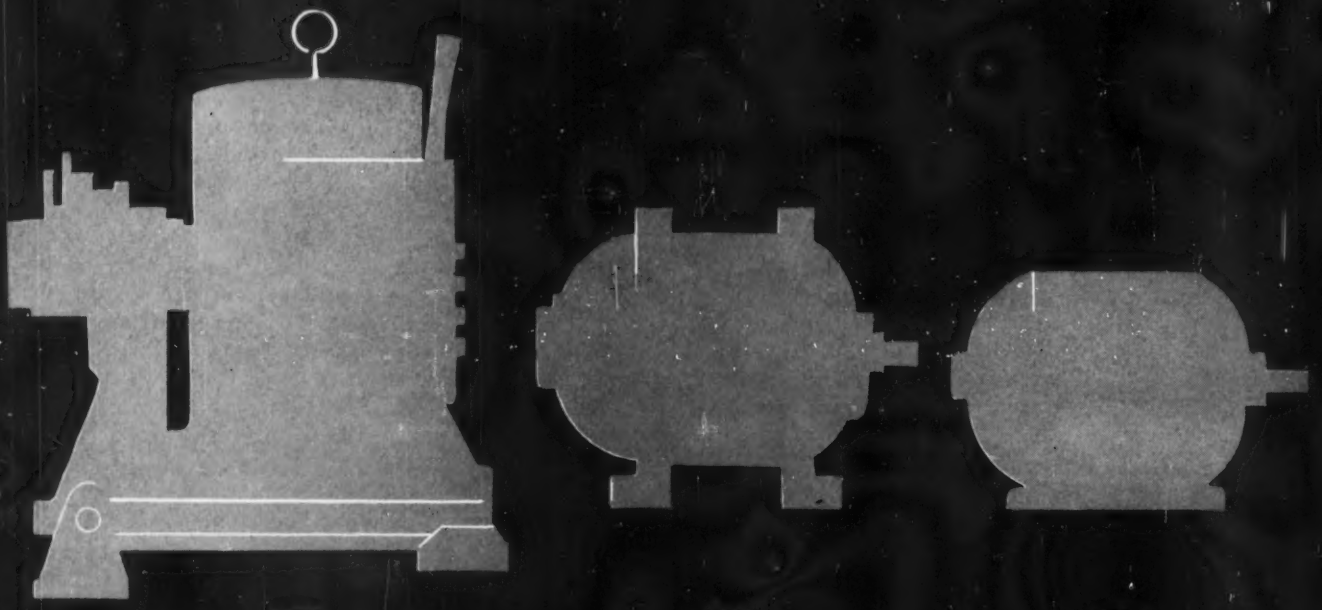
5 Can be ceiling-mounted without extra fittings.

6 8-foot channels for minimum suspension points.

For the complete story of this beautiful new streamlined direct-indirect luminaire, write for an 8-page 3-color folder. The F. W. Wakefield Brass Company, Vermilion, Ohio. In Canada, Wakefield Lighting Ltd., London, Ont.

Wakefield Over-ALL Lighting

WHAT'S NEW IN MOTORS



1888
TESLA
5 H.P.
765 LBS.

1926
CS
5 H.P.
130 LBS.

1947
LIFE-LINE
5 H.P.
119 LBS.

IS STILL TO COME . . .

Hear anything about a new motor? Well, if you think you have, let's set the record straight . . . What's New In Motors Is Still To Come!

Westinghouse has been a leader in the designing and manufacturing of motors for over 60 years. During these many years, over 20 million dollars has been spent on the development of basic lines of induction motors to maintain this leadership. Here are the real years of "new motors" in the parade of progress:

1888—*THE FIRST A-C MOTOR—THE WESTINGHOUSE TESLA MOTOR*

1926—*THE FIRST SEALED SLEEVE BEARINGS—THE WESTINGHOUSE CS MOTOR*

1947—*THE FIRST MOTOR WITH PRE-LUBRICATED BEARINGS PLUS A ⅓ WEIGHT AND SIZE REDUCTION—THE WESTINGHOUSE LIFE-LINE MOTOR*

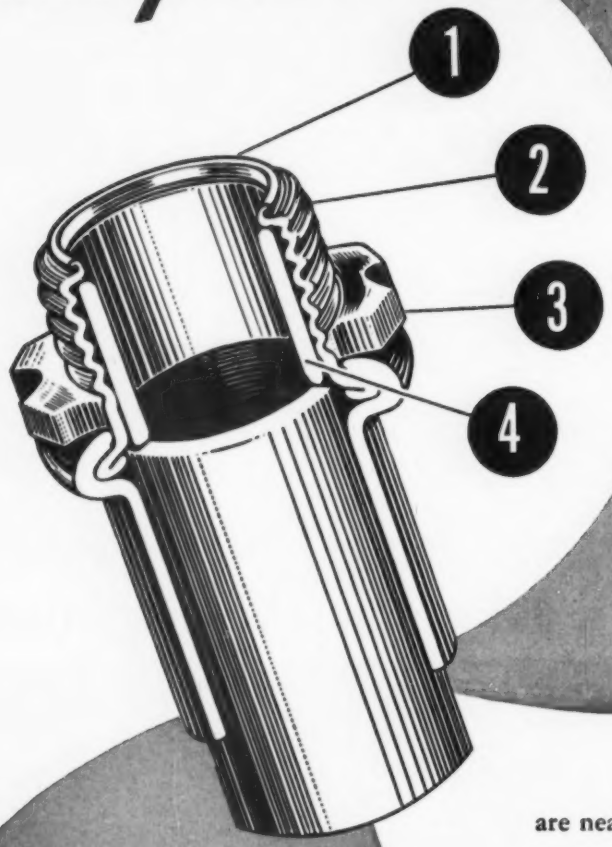
The smaller, lighter Westinghouse Life-Line Motor of 1947 was the last major contribution. *AND FOR THE NEXT ALL-IMPORTANT STEP AHEAD IN MOTOR PROGRESS . . . LOOK TO WESTINGHOUSE.*

YOU CAN BE SURE.. IF IT'S Westinghouse

J-21834

New B-M 21 E Connector

HAS 4 OUTSTANDING FEATURES



1 Smooth Rolled Edge Throat will not cut or scrape plastic insulation.

2 Full thread screws into all conduit fittings.

3 Nut screws down flush to shoulder for positive ground.

4 Internal sleeve same inside diameter as tubing insures smooth raceway for easy fishing.

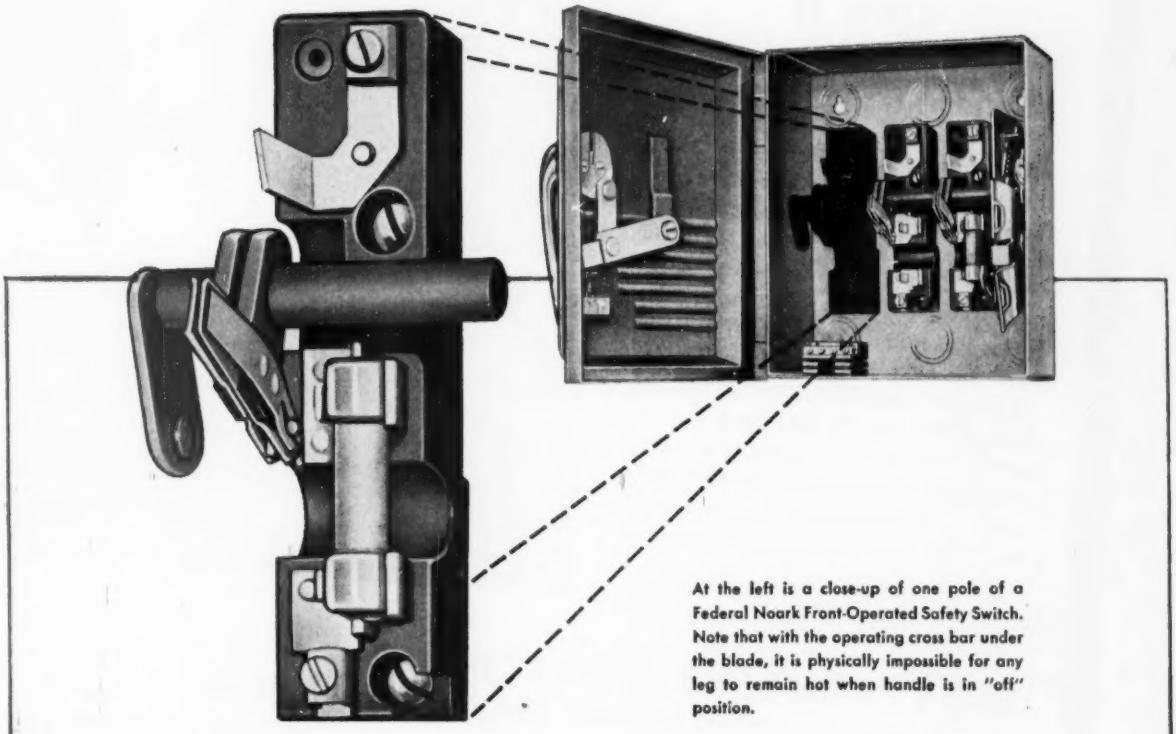
All B-M Indenter Fittings are U. L. approved as Concretetight and for General Use. (File Card E 10863)

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

BRIEGEL METHOD TOOL CO.

GALVA, • ILLINOIS

FOR SAFETY'S SAKE...OPERATING CROSS BAR UNDER THE VISIBLE BLADES



At the left is a close-up of one pole of a Federal Noark Front-Operated Safety Switch. Note that with the operating cross bar under the blade, it is physically impossible for any leg to remain hot when handle is in "off" position.

FEDERAL NOARK has gone the limit to assure you the safest industrial switch ever designed. Federal Front-Operated, for instance, is the *only* visible-blade switch with the operating cross bar *beneath* the switch blades where it unfailingly protects the operator...forces the blades open...guarantees current break.

And for complete, all-around efficiency, these switches have a man-size front-operated handle that positively snaps the switch to "On" and "Off"...a double fibre hook to pull the blades in...a patented high pressure fuse holder that holds the fuse like a vise and that has a minimum number of joints, assuring coolest operation and longest service life.

In addition, special design features make these industrial switches the easiest to install and maintain. Order Federal Noark Front-Operated Industrial Switches from your distributor for the best in modern design and the biggest dollar value on the market today.

Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

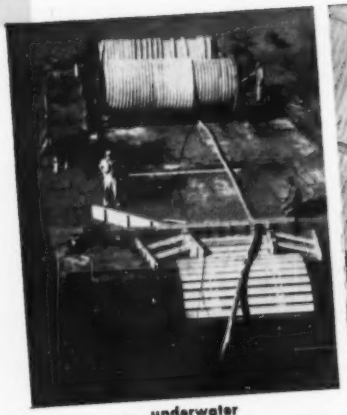
Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

FEDERAL NOARK®

case history

use it anywhere

The versatility of Okolite rubber-insulated high voltage cables is demonstrated by these three typical installations. The first shows an installation of the Portland General Electric Company—two 1,800-ft. 13-kv rubber-insulated submarine cables being laid across the Willamette River. The next shows six 23-kv Okolite-Okoprene transformer leads at The Diamond Portland Cement Company. The bottom, four 390-ft. spans of three-conductor self-supporting Okolite-Okoprene cables at the Covington, Virginia plant of West Virginia Pulp and Paper Company.



. . . . . underwater

. . . . . in racks or conduit

. . . . . on messenger

WHY THEY'RE SWITCHING TO OKOLITE rubber-insulated cables for use up to 35,000 volts

There is a distinct trend among industrials and public utilities toward Okolite rubber-insulated cables for high voltage use.

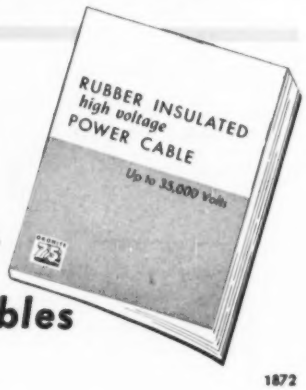
ADVANTAGES

1. Lighter and easier handling.
2. Eliminates sheath corrosion and fatigue.
3. Simplifies splicing and terminating.
4. Moisture does not affect the insulation.
5. No oil migration at high temperatures or elevations.
6. Flexibility simplifies installation.

APPLICATIONS

1. Transmission and distribution circuits.
2. Generator and transformer leads.
3. Vertical risers and shaft cables.
4. Submarine power cables.
5. Portable substation cables and test leads.
6. X-ray cables.

In the air, underground, underwater, in racks, ducts or conduits, Okolite-Okoprene rubber-insulated high voltage cables can be installed easily and permanently. The design and construction of this type of cable has been proved in all kinds of service for more than 25 years. The entire subject of rubber-insulated cable for high voltage application is covered in the new Okonite 128-page manual illustrated at right. Write for Bulletin EC-1075 on your letterhead to The Okonite Company, Passaic, New Jersey.



OKONITE SINCE 1878 *insulated cables*

1872

The second of two articles on profits

What Are PROFITS Used For?

This is the second article on the role of profits in our economy. The first was addressed to the question: "How High are Profits?" The answer was found to be: not high when compared with previous years and the present investment in corporate facilities. This second article is addressed to the equally important question: "What do corporations do with their profits?"

In 1953 corporations will earn about $20 billion *after taxes*, if the recent rate of earnings is maintained throughout the year. These profits will be used (1) to expand and improve productive capacity through purchases of new plant and equipment, (2) to finance the operations involved in a growing volume of business and (3) to reward the people who have invested their money in American industry. Of the $20 billion, the corporations will pay about $9 billion to their stockholders as dividends. They will use the $11 billion that remains to purchase new plant and equipment and to increase their working capital.

This year corporations are increasing their plant, equipment and working capital by a total of approximately $32 billion. Of this amount, about $26 billion is for new plant and equipment. The remainder is for working capital. As this article will show in greater detail, about $21 billion of this will come from depreciation allowances and sales of new securities. The other $11 billion will come from retained profits.

It is impossible to trace exactly how each dollar of retained profits is spent. This money is mixed with other money that goes into the company treasury in the form of proceeds from loans, sale of securities and depreciation allowances. *However, it is a fact that by retaining $11 billion of their profits this year, corporations have provided $11 billion toward their total capital requirements, including the money needed for expanded and improved capital equipment.*

Profits Mean New Plants

This year American industry is engaged in a very large expansion of plant facilities. This will increase the industrial capacity of the nation by about 7 per cent. Since 1950, our capacity has been increased by about 12.5 per cent. And all of this expansion has been privately financed, even though about one-third of it was certified as necessary for national defense.

The expenditure during 1953 of $26

billion for new plant and equipment—an alltime record—imposes terrific financial responsibilities on our corporations. About one-half of the amount required will come from depreciation allowances. In general, these allowances are supposed to pay for the replacement of worn-out or obsolete equipment. Another $8 billion will be raised by corporations through new security issues and long-term mortgage loans. All together, depreciation allowances, security issues and long-term loans will provide about $21 billion. But this is still $5 billion short of the $26 billion needed for new plant and equipment this year. Thus, it is retained profits that spell the difference between expansion and standing still, between growth in the productive capacity of the economy and running downhill.

As plant facilities are expanded, corporations also need more working capital. A larger volume of business requires larger inventories, larger accounts receivable and larger amounts of ready cash to meet payrolls and bills for materials. The increase in these items during 1953 is estimated at $8.5 billion, of which about $2.5 billion will be supplied by short-term bank loans. The other $6 billion will come from retained profits. Thus, retained profits provide an essential $11 billion—$6 billion for working capital, $5 billion for new plant and equipment—to meet corporate financial requirements.

Incentive for Investment

The role of the profits that are paid to stockholders as dividends or to employees under profit-sharing plans is even more important than the role played by retained profits in providing plant, equipment and working capital. Dividend payments provide the main incentive for investment in the stocks of corporations. They are the reward for risks taken by investors. Dividends paid by corporations whose common stocks are listed on the New York Stock Exchange provide an average return of about 6.5% at present prices, and dividends on preferred stocks average about 4.5% return. Dividends are distributed among 6.5 million stockholders. Also, it is estimated that 3 million employees now are covered by profit-sharing plans. These plans increase the incentives of both production workers and managers to work harder and more efficiently.

Thus, more than 9 million Americans have a *direct* financial stake in corporate profits through ownership of stock or participation in profit-sharing plans. But *all* Americans share indirectly in the rewards of a successful business year. Investment of a major part of 1953 profits in new plants and equipment means more employment opportunities and better working conditions for labor. For the nation, it means new industrial capacity that is essential both for national defense and to produce more and better goods for a rising standard of living.

Corporate profits after taxes represent about 6% of the nation's total income. But the job they do to stimulate investment and to finance industrial expansion and improvement is more far-reaching and more essential to the prosperity and well-being of the American people than would be suggested by that small figure.

McGraw-Hill Publishing Company, Inc.

1953 Headquarters for

LOW VOLTAGE CIRCUIT BREAKERS

is your

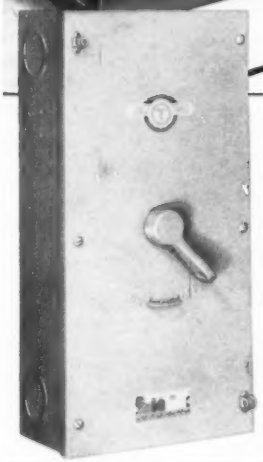
TRUMBULL (T) DISTRIBUTOR

Superior design and construction features enabled Trumbull to develop circuit breakers that withstand the moisture, high-shock, and vibration of shipboard service required by the U. S. Navy. These same basic features enable your Trumbull Distributor to meet your *specific* needs from Trumbull's *complete* line.

Trumbull Circuit Breakers for load centers, panelboards, switchboards, for industrial, commercial and residential applications, provide greater safety to operators, better circuit protection against both shorts and sustained overloads. They pay off in convenience, permanence and fast restoration of service.

Available in ratings from 10 to 600 amperes and voltages up to 600 volt AC, 250 volt DC, either open type or with surface or flush-mounted enclosures, of semi-dust-tight, water- and dust-tight design. Accessories available for conversion to non-automatic, remote tripping, bell alarm and other special requirements.

Trumbull Circuit Breakers and breaker-equipped load centers, panelboards and switchboards, plus the advice of qualified Trumbull sales engineers, are available through leading Distributors everywhere. Write direct for literature or technical information.



Trumbull AT enclosed circuit breakers feature "trigger" trip, automatic tripping, silver-alloy contacts, individual calibration. 2- and 3-pole construction, from 15 to 600 amperes, 125 to 600 volt AC or 125 to 250 volt DC. Single pole available in 50-ampere frame size breakers, 125 volt AC or DC.

Trumbull TQL (plug-in) and TQ Circuit Breakers feature *both* thermal and magnetic protection, "trigger-type" quick-make and break, trip-free operation, trip-indicating handle, silver-plated contacts, arc-quenching chamber. Individually calibrated and sealed in compact, dead front phenolic cases. Ratings: 10 to 50 amperes, 120 volt AC, single pole.

TYPE TQL TYPE TQ

Trumbull K-173 Marine Hi-Shock Circuit Breakers, 3-pole, 125 volt AC or DC, 50 ampere frame size. Suitable for protection of lighting mains, feeder circuits, single load circuits supplying motors, radar, sonar, etc.

GENERAL ELECTRIC

TRUMBULL COMPONENTS DEPARTMENT
PLAINVILLE, CONN.

1878: *Thomas Edison builds an electric motor for his Menlo Park "Express."* . . . **1910:** *G.E. establishes motor leadership in the infant electric industry.* . . . **1925:** *G.E. adds 4 times more power per pound as it develops newer models.* . . . **1939:** *first Tri-Clad motor sets 14-year standard.*

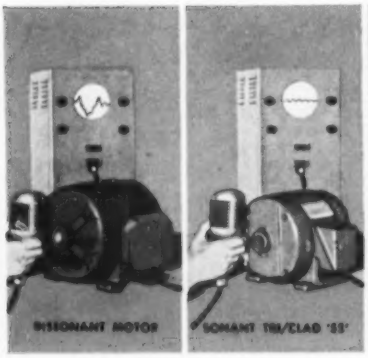
General Electric Announces...

A NEW MILESTONE IN MOTOR HISTORY

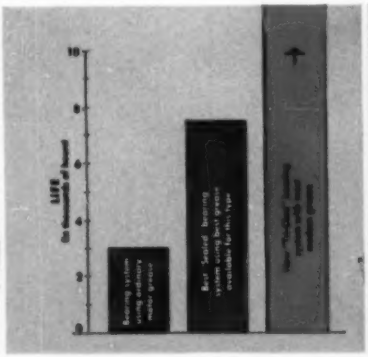
New TRI 55 CLAD motor climaxes 75 years of engineering leadership

The General Electric Tri/Clad '55' is an important milestone in motor history. For this is a *completely new motor*. Born out of thousands of engineering man-hours, the Tri/Clad '55' incorporates design improvements that go far beyond mere modifications. Many years of pure research, the discovery of new, better materials, the knowledge of how to make better use of present materials, and improved manufacturing processes all make the Tri/Clad '55' motor the new leader in the motor field.

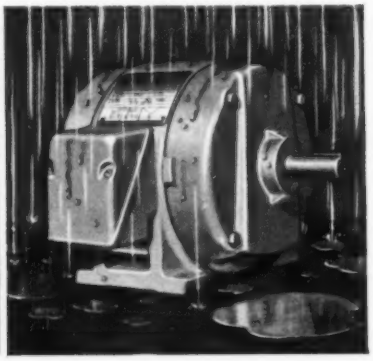
You as a motor user should take the opportunity to see and test this motor for yourself. Contact your nearest G.E. Apparatus Sales Office or G.E. Motor Agent and tell him you want to see the new G-E Tri/Clad '55'. General Electric Company, Schenectady 5, N. Y. 648-4



DESIGNED FOR BETTER PERFORMANCE: Tri/Clad '55' has a low noise level . . . runs cool . . . gives up to 53% increase in shaft output per pound...has higher full-load speeds.



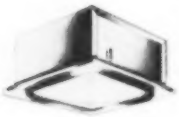
ENGINEERED FOR LESS MAINTENANCE: 10%-life tests (such as the one shown) prove the Tri/Clad '55' bearings last longer without regreasing than any other bearing system.



BUILT TO LAST LONGER: cast-iron strength . . . more fully enclosed dripproof construction . . . water-shedding stator windings . . . polyester film insulation 8 times stronger.

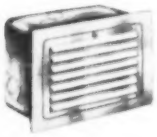
GENERAL ELECTRIC
TRI-CLAD INDUCTION MOTOR
MODEL
HP
FL RPM
VOLTS
PHASE
CYCLES
FL AMP
TYPE
FRAME
TIME RATING
C RISE
TRI 55 CLAD
THE LEADER IN MODERN MOTOR DESIGN
Progress is our most important product
GENERAL ELECTRIC

DERBY DOWNLIGHTS—Endless applications. 7" diameter recessing downlights, available with matt black removable louver or with Holophane Controlens*. UL approved.

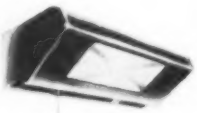


DUO-FRAME UNITS—Recessing units with Holophane, Corning, and Phoenix glassware. Two-piece frame. Drop hinges. Vertical and horizontal lamp mounting units. UL approved.

EXIT SIGNS—Surface, recessing, top and end mounting units. Metal stencil sign faces, backed by red glass. HOT-BONDED lustre aluminum finish. UL approved.



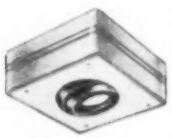
NITE LITE—One-piece, die-drawn recessing box. Louvered face with concealed hinge for easy servicing. Stainless steel or baked lustre aluminum finish. UL approved.



BED LAMP—Direct-indirect hospital unit. For three 50/60 watt lamps. Stainless steel finish. Controlens* panel in bottom, diffusing glass in top. UL approved.

PLEXOLINE® ACCENT UNITS—For use singly or with PLEXOLINE linear units. Adjustable and fixed units. Louvered body provides spill light on sides. UL approved.

TROFFER ACCENT UNITS—Self-contained square recessing units, adjustable or fixed, flange or snap-in type. May be used singly, within or at end of troffer runs. UL approved.



SURFACE MOUNTED ACCENT UNITS—Adjustable units or fixed units with Holophane Controlens*. May be used singly or with VIZ-AID® or LENOX® fixtures. UL approved.

RECESSING CORRIDOR UNITS—Available with two optical characteristics: asymmetric and symmetric. Flange or snap-in. Holophane* prismatic glass globe. UL approved.

*® HOLOPHANE CO., INC.

A complete line of incandescent units by Day-Brite

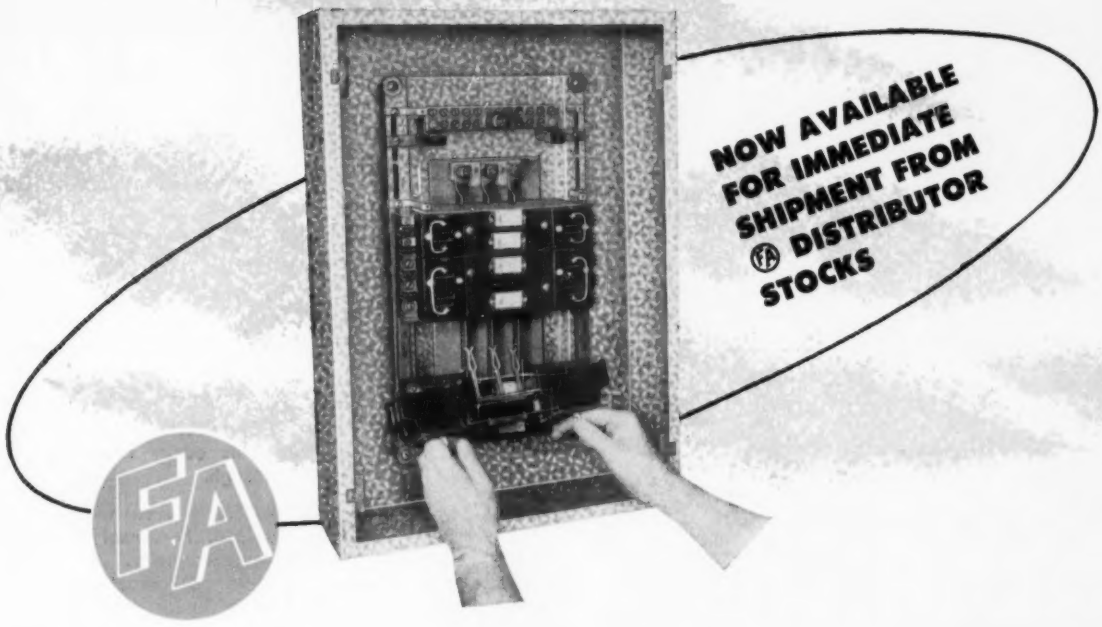
When the name "Day-Brite" is mentioned, you think of the nation's finest line of fluorescent fixtures. This is to remind you that there's an equally fine line of Day-Brite incandescent units—giving you the advantages of Day-Brite quality and design for every piece of equipment called for in any type of lighting job. Write for full descriptive product information on the Day-Brite incandescent line. You'll find it a valuable addition to your files.

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo.

In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario

373



PLUG-IN feeder distribution PANELBOARDS

You'll save time, labor and money by using this new type panel for all your feeder distribution needs. Approved by the Underwriters' Laboratories, Inc., for label service, these new and improved panels are of the "panel base assembly" type, which means that mounting back with main bus bar and lugs, box and front, and required switching units are readily available from FA distributor's stocks for quick and easy assembly on the job. (Factory assemblies also available.)

Two dependable FA switching units — the Pulfuzswitch and the Klampswitchfuz — make these panelboards the finest in safety and efficiency. Both types combine switch and fuse in one unit so that current is "off" when the fuse carrier is removed and the door opened. This makes replacement of fuses safe, quick and easy.

Boxes are standardized in width, height and depth to meet almost any combination or job requirement. Standard knockouts in ends are provided in 19″ wide boxes; removable ends to permit drilling of conduit openings on the job are provided in the 24″ wide boxes. Generous wiring space and ease of installation are other features of these new and better panelboards.

Another extremely popular feature of these new assemblies is that they are expandable. Not only do they provide the branch circuits needed for today but they are so designed that future additions of circuits and changes in capacity are a simple matter of plugging in new units.

Use these new panelboards for all your feeder distribution needs. Capacities are, 250 volt AC or DC and 600 volt AC service, 200, 400 and 600 ampere mains and 30, 60, 100 and 200 ampere, 250 volt branches; and 30 and 60 ampere, 600 volts, all in the 24″ boxes. 200 ampere, 250 volt maximum mains, 30 and 60 ampere maximum branches (illustrated above) in 19″ boxes.

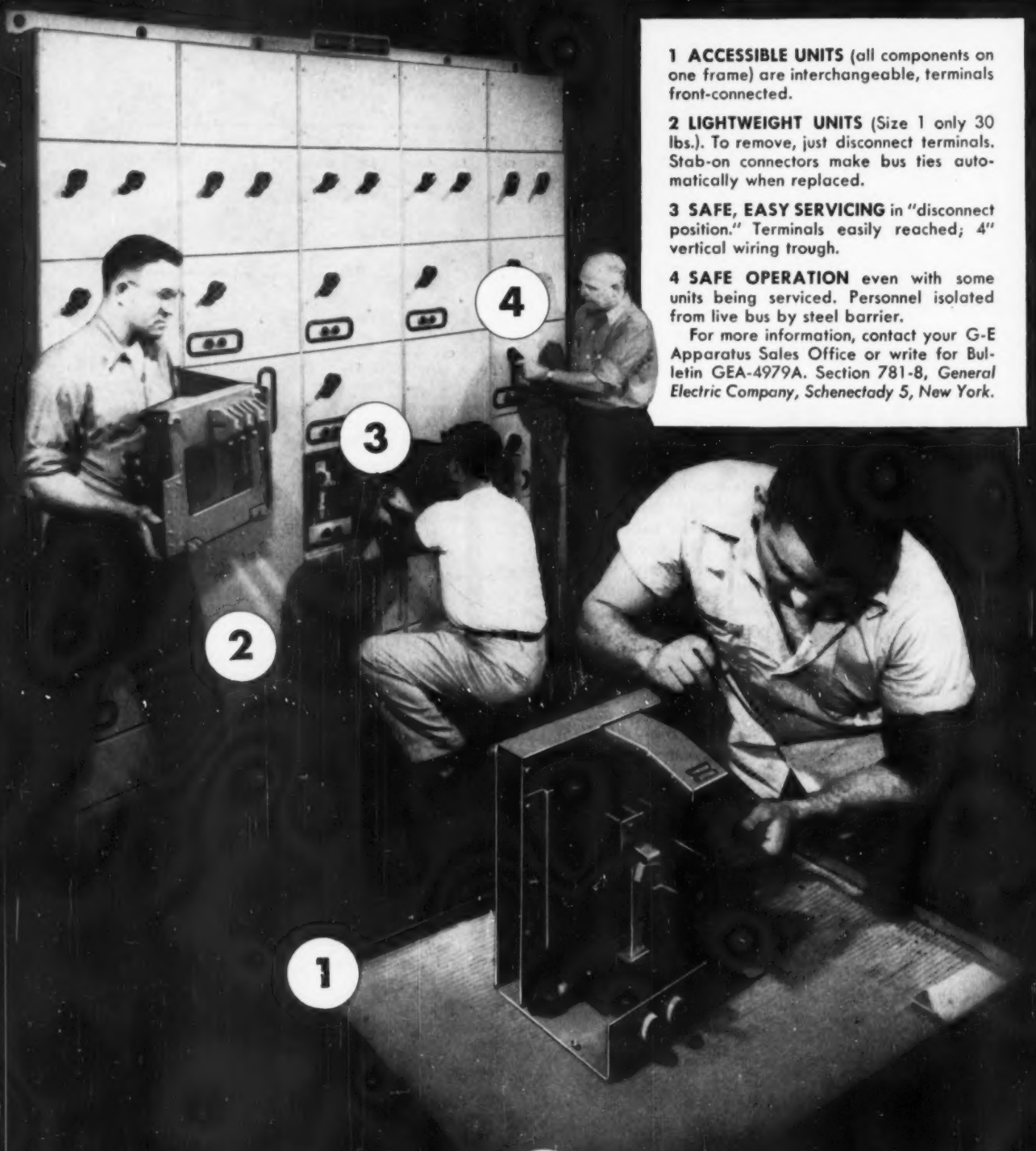
For further information about these new and extremely efficient panelboards, see your nearest FA Distributor or consult your nearest FA Representative listed in Sweet's.

Frank Adam Electric Co.

BOX 357, MAIN P. O.
ST. LOUIS, MISSOURI

Makers of: BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

G-E MOTOR CONTROL CENTER— 4 EASY-MAINTENANCE FEATURES



1 ACCESSIBLE UNITS (all components on one frame) are interchangeable, terminals front-connected.

2 LIGHTWEIGHT UNITS (Size 1 only 30 lbs.). To remove, just disconnect terminals. Stab-on connectors make bus ties automatically when replaced.

3 SAFE, EASY SERVICING in "disconnect position." Terminals easily reached; 4" vertical wiring trough.

4 SAFE OPERATION even with some units being serviced. Personnel isolated from live bus by steel barrier.

For more information, contact your G-E Apparatus Sales Office or write for Bulletin GEA-4979A. Section 781-8, *General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

COLUMBIA

easy bending . . . easy "fishing"

E.M.T.

The smooth, clean inside enamel finish of Columbia E. M. T. makes wire-pulling easy. The galvanized coating prevents corrosion. Every length is thoroughly inspected before shipment—always uniform. Plus, Columbia gives you service that keeps your installations "on-schedule."

Approved by Underwriters Laboratories
Serving the Electrical Wholesaler Since 1912

Columbia CABLE & ELECTRIC CORP.
255 Chestnut St. Brooklyn 8, N. Y.

NON-METALLIC SHEATHED CABLE

FLEXIBLE STEEL CONDUIT

E. M. T.

A.B.C. ARMORED CABLE

Sales Representatives in These Cities

Atlanta, Ga.
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Coral Gables, Fla.
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Detroit, Mich.
Glassport, Pa.
Highland Park, Mich.
Houston, Tex.
Los Angeles, Calif.
Minneapolis, Minn.
New York, N. Y.
Philadelphia, Pa.
Portland, Ore.
St. Louis, Mo.
San Francisco, Calif.
Seattle, Wash.
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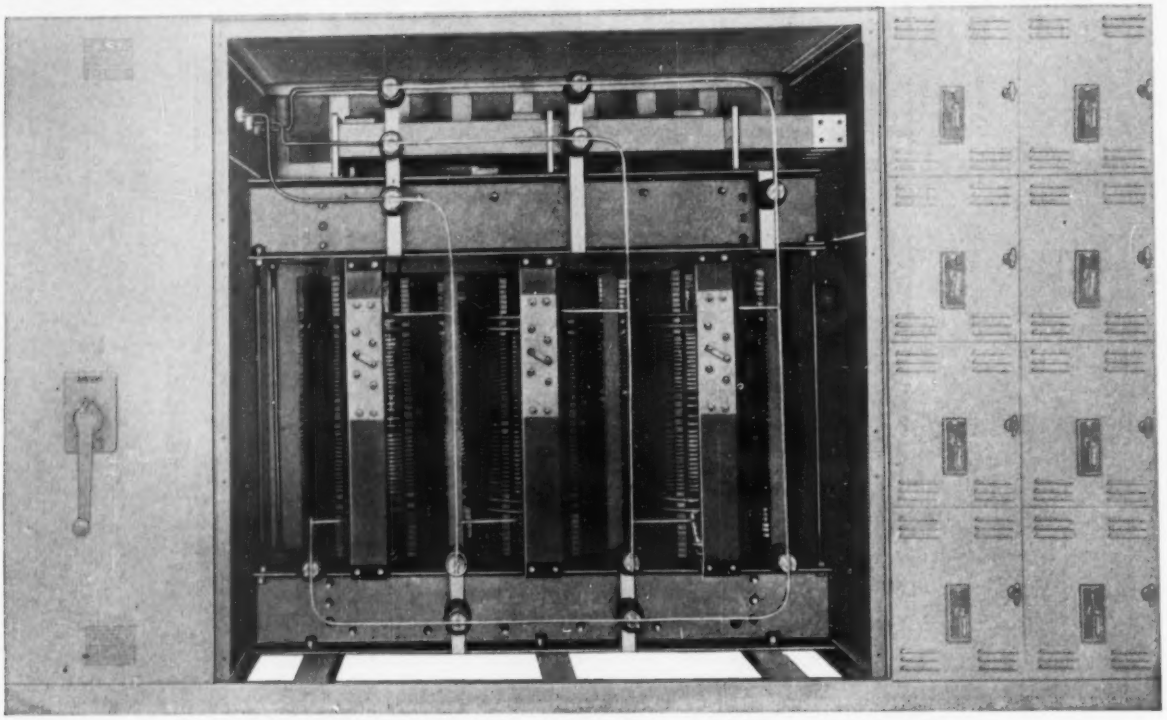
The transformer is the heart of a substation



1000 Kva 13,200 volt substation—with transformer compartment panel removed

A substation is no better than its transformer; therefore, it is important that the transformer is of the best quality—a Sorgel air-cooled dry-type transformer.

Dry-type transformers are the most practical type for indoor installations. They require little or no maintenance; no liquid to check or replenish; no fire hazard; small and compact; economical; easy and convenient to install; no vault required; can be placed close to load center, resulting in better voltage regulation. Easily moved when required for expansion or alterations.

Sorgel air-cooled dry-type transformers are top quality, time tested, and are thus recognized and accepted by discriminating engineers and users. Their rugged construction assures continuous, reliable service. Liberal design. High efficiency. Low noise level.

The Sorgel Electric Co. has had over 35 years of experience in the development, manufacturing and application of dry-type transformers.

Sorgel air-cooled transformers are procurable with any make of switch gear, and from any substation manufacturer.

¼ Kva to 3000 Kva.

All voltages
120 to 15,000 volts

SORGEL
AIR-COOLED
Dry-Type
TRANSFORMERS

Top Quality
Time Tested

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled Dry-Type Transformers—Over 35 years

"POT HOLDER"- Industrial Style

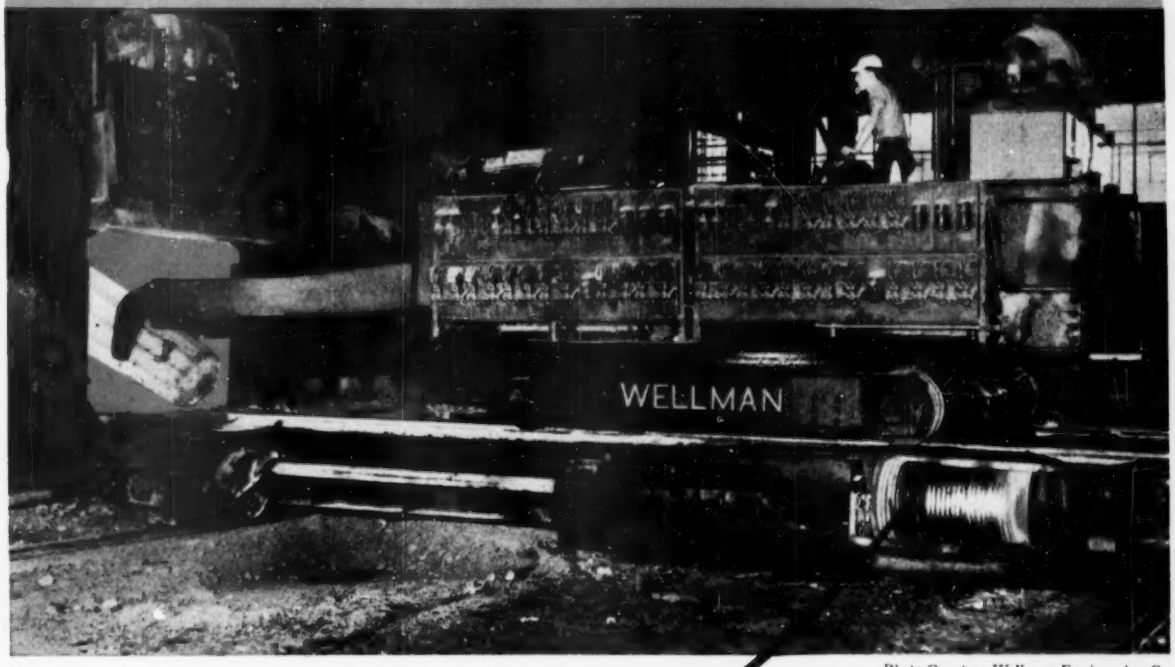


Photo Courtesy Wellman Engineering Co.

This is the industrial equivalent of the domestic pot holder. The charging and drawing machine picks up heavy ingots and puts them into and removes them from the furnace.

Overhead trolleys, as well as third rails, are frowned upon as sources of power because of safety reasons and so the steel mill wisely chose TIREX Cables for the important job of supplying electric power to this machine.

The user knows better than anyone else how important this machine is to his operation. So he uses cured-in-lead TIREX to insure the dependable operation of this charging machine. The cable is subjected to heat, to flying sparks, to oil, abrasion and other harmful agents. It is reeled and unreeled all day long. Even this doesn't bother the Selenium Neoprene Armor.

Isn't the fact that this steel mill depends upon TIREX Cables ample evidence of their superiority? Doesn't this mean you could profit by their experience? We think so, too. Why don't you specify and be sure you get TIREX for every type of portable cord or cable operation? You will not be sorry you placed your faith in TIREX.

Simplex WIRES & CABLES

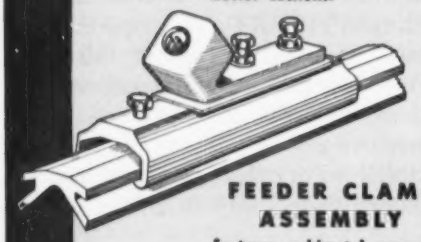
TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts

The Keystone INTEGRATED ALUMINUM* Conductor System

HANGER SECTION
Conductor free to slide within support, allowing for expansion and contraction.

JOINT PLATE AND BOND ASSEMBLY
Non-loosening spring-type splice plate provides excellent electrical and mechanical joint characteristics between conductor sections.



FEEDER CLAMP ASSEMBLY
features a bimetal separator that eliminates galvanic corrosion between copper terminal and aluminum surface, providing foolproof, long-lasting connection.

LOWER COST

LIGHTER WEIGHT, HIGHER EFFICIENCY

SAFER ENCLOSURES

An integrated power supply system designed to complement the best materials handling equipment—1000 amperes capacity for heavy duty systems . . . economical for use on control circuits.

The Keystone Aluminum Conductor System is now being employed in outstanding installations, after having been developed through years of research in the laboratory and industry. It has been carefully designed to solve the troublesome problems formerly encountered.

The light weight of this conductor system reduces costs of installation, insulators and supporting structures. Its non-corrosive qualities permit use on sensitive control circuits. Longer contact life. Compact design saves space, permits better protection. All components are pre-fabricated. Available complete with brackets and enclosures. No copper boosters nor priorities needed. Easily engineered, installed and maintained.

*Domestic and Foreign Patents Pending

Write today for new, illustrated 4-page folder on Keystone Integrated Aluminum Conductor System.

ELECTRIC SERVICE MANUFACTURING CO.

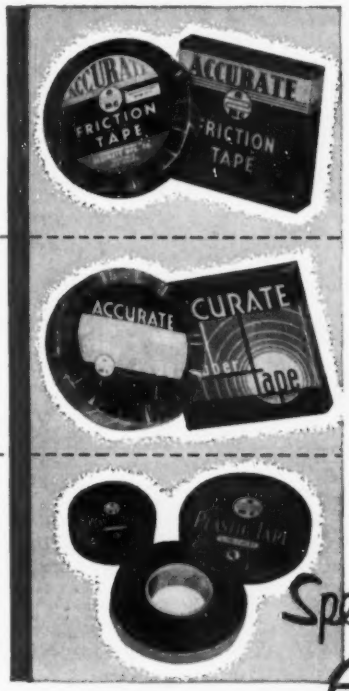
PHILADELPHIA 32, PENNA.

-when it's taped with ACCURATE

ACCURATE FRICTION TAPE – High grade rubber carefully compounded with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M.

ACCURATE RUBBER TAPE – Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M. –A.A.R. grades.

ACCURATE PLASTIC TAPE – Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.



SUPER AGING QUALITIES MAKE THE DIFFERENCE!

Electrical wraps made with Accurate Tape actually improve with age. The raw materials engineered into Accurate Tapes are selected for extra durability and maximum electrical and mechanical protection. For example, Accurate Rubber Tape features high elasticity, excellent cohesion, high dielectric and super aging qualities. No heat or extra pressure is required during application, yet the job improves with age. Whether you use Accurate Friction, Rubber or Plastic Tape, you can be sure there's no finer tape at any price . . . Accurate provides positive tape protection!

WRITE FOR NEW CATALOG—All you need to know about electrical tapes in one handy brochure. Call or write for your copies to:
ACCURATE MFG. COMPANY, GARFIELD, N.J.

Specify **ACCURATE**

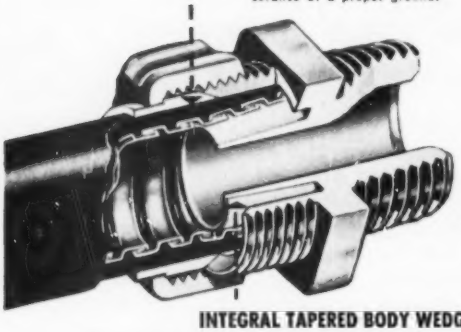
YOUR BEST BUY IN TAPE!

MORE THAN A QUARTER CENTURY OF TAPE SPECIALIZATION

NOW...keep wiring really liquid-tight with *NEW* T&B Connectors for liquid-tight flexible metal conduit

PLASTIC GRIPPING RING

- Seamless, pliable, oilproof plastic forms perfect seal with plastic conduit sheath.
- Protects conduit sheath against damage.
- Blue color gives visual installed insurance of a proper ground.



INTEGRAL TAPERED BODY WEDGE

- Positive ground for metal conduit armor.
- Fits all thicknesses and convolutions in standard liquid-tight flexible metal conduit.
- Grounding member integral with body.

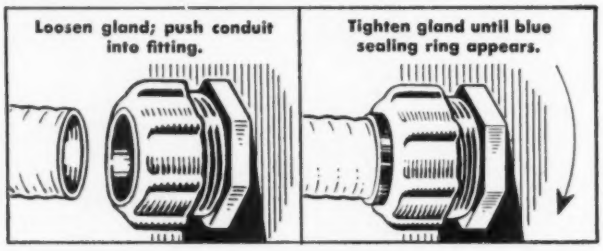
Seal out all moisture, oil, and corrosive fluids with this easy-to-install, self-grounding connector . . . a connector specially designed by T&B for Types UA and EF (J.I.C. Standard) liquid-tight flexible metal conduit.

Just push conduit into connector body and take up on gland nut until blue plastic ring appears. No need to disassemble connector. No twisting of conduit. Same wrench fits both body and gland.

Integral tapered body wedge positively grounds metal conduit armor. Plastic-to-plastic seal between gripping ring and conduit jacket makes tight leak-proof connection. Straight connectors, 45° and 90° elbows available for conduit from 3/8" to 2".

Send for sample and engineering data today.

A CINCH TO INSTALL—



LOOK FOR THIS SIGN — Authorized T&B Distributor ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T328

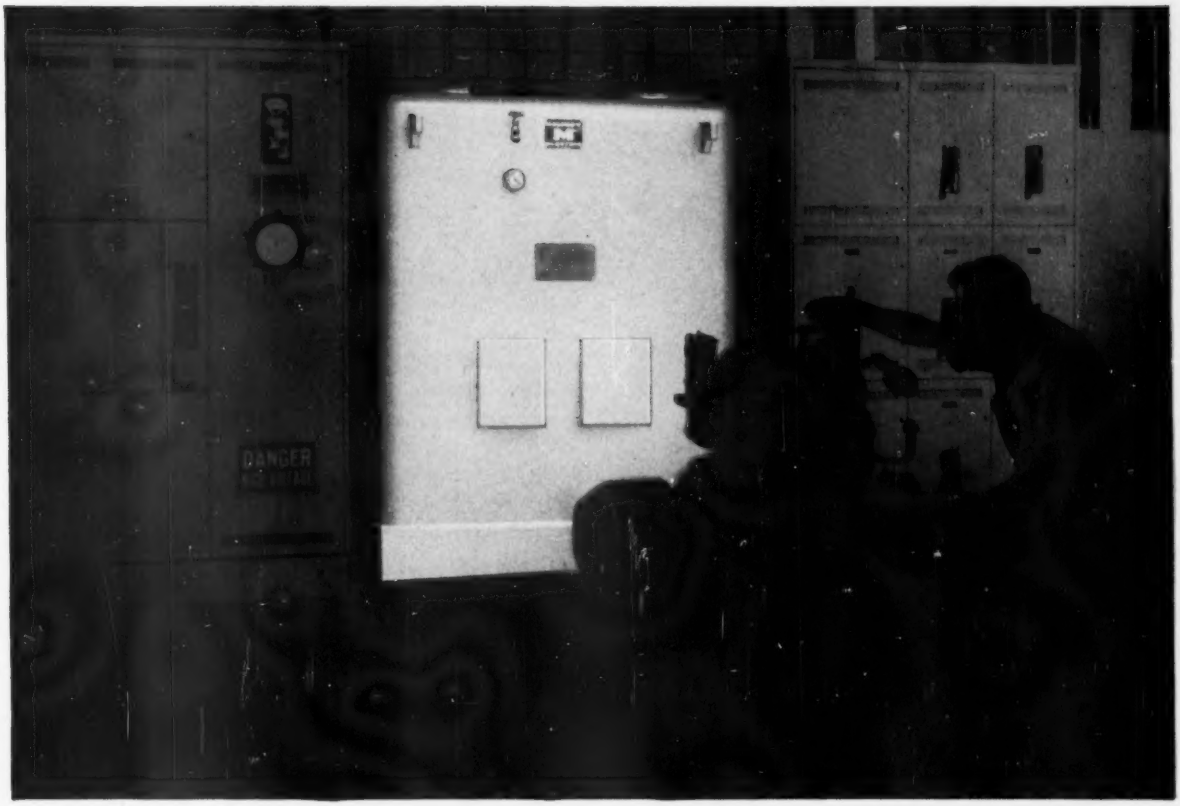
THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P. Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

WHERE SAFETY IS FIRST



Specify Moloney Class "H" Dry Type Transformers . . .

Safety of men or machines is no problem when you install Moloney Nitrogen sealed Class "H" insulated Dry Type Transformers. For Moloney offers you more in increased protection against fire and explosion hazards. These versatile and dependable transformers can be located indoors or outdoors *right next to the job* and more than meet the most exacting insurance requirements. And this also means important savings in costly copper connections . . . less danger of accidental power interruptions.

Nitrogen filled Class "H" insulated Dry Type Transformers do not produce toxic gases, never need expensive vault installations. Maintenance is easy and the nitrogen atmosphere protects insulation from oxidizing, means longer, more dependable transformer life.

Solve your load center problems the practical way with the modern transformers that go where *you* want them—the Nitrogen sealed Class "H" Dry Type Transformers with the "extra value" that is the mark of Moloney.

MES3-28

MOLONEY ELECTRIC COMPANY

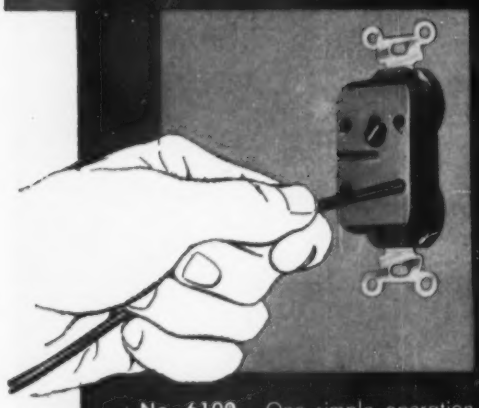
Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

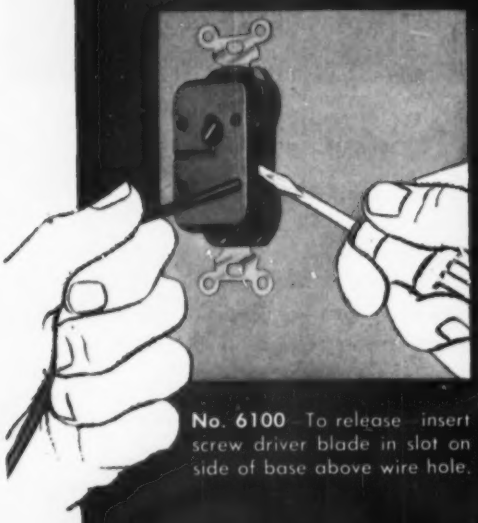
FOR EASIER, FASTER WIRING

with new screwless terminals

THE ANSWER IS BRYANT



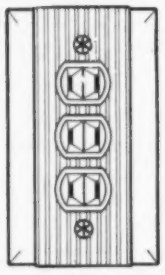
No. 6100 One simple operation to wire. Insert wire in bottom hole the connection is complete. This device has concealed yoke and washer type ears.



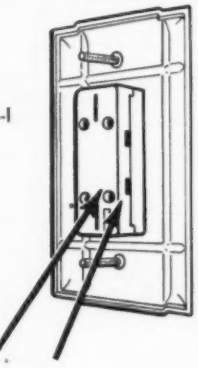
No. 6100 To release insert screw driver blade in slot on side of base above wire hole.

The new Bryant 6100 line of quality outlets is equipped with time-saving, cost-cutting screwless terminals that mean easier, more efficient wiring jobs for you. The 6100, 6100-I duplex convenience outlet and the 6123 and 6123-I triple outlet with plate assure famous Bryant quality with these features—

- **All plastic safety construction—live parts completely enclosed to guard against shock**
- **Straight-in wiring—no bending or looping**
- **Handy wire strip gage**
- **Double-sided contacts assure positive electrical connection**
- **Screwless terminals will take solid wire Nos. 14, 12 or 10—stranded wire Nos. 14 or 12**
- **Underwriters require that wire must withstand 50 lb. pull. Nos. 6100 and 6123 exceed this requirement.**
- **Fit all standard switch boxes**
- **Rated 15 amperes, 125 volts, 10 amperes, 250 volts**
- **The 6100 line is available in brown or ivory**



No. 6123, 6123-I (not shown)



The 6123 and 6123-I provide three outlets complete with one plate. To wire . . . insert stripped wire in bottom hole . . . to release . . . insert screw driver in slot.

Specify Bryant From Your Electrical Distributor

BRYANT
SUPERIOR WIRING DEVICES

Listed by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

Chicago • Los Angeles

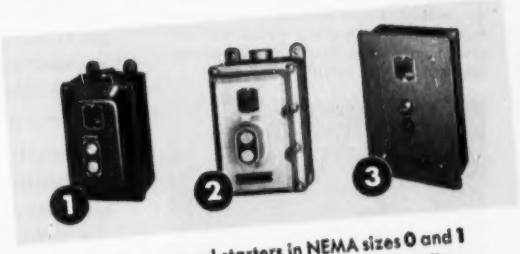
J-99899

for DEPENDABLE PERFORMANCE!

Square D Manual Motor Starters

More than a million Square D Manual Starters have been put to work during the past twenty years on small machine tools, punch presses, fans, blowers, grinders, buffers, pumps, compressors, and portable electric tools. They've been selected for a lot of good reasons —among them:

Dependability. They're designed to "take it." **Operator Safety.** Cover and "STOP" button can be padlocked. **Convenience.** They're easy to install. **Overload Protection.** Melting alloy overload relays of unit construction provide close, accurate motor protection—"trip-free" mechanism prevents holding motor circuit closed against overload. **Parts Kits** simplify and speed up normal maintenance.



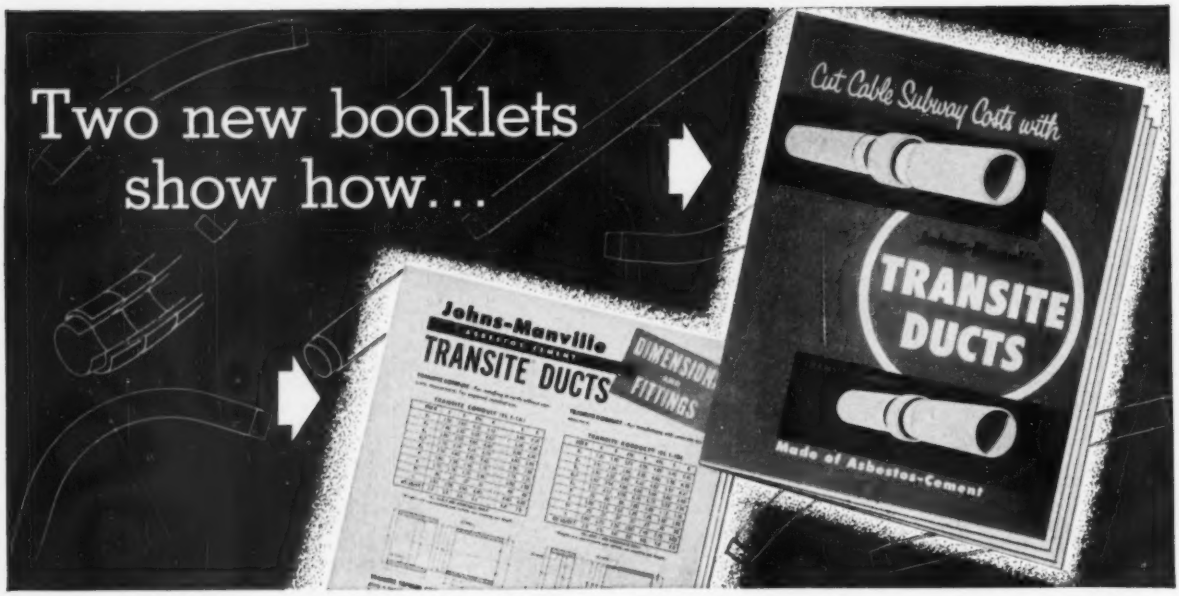
Square D offers manual starters in NEMA sizes **0** and **1** for non-reversing, reversing, or two-speed applications. A variety of enclosures is available. Shown above **1** Water and Dust Tight **2** Hazardous Locations **3** Flush Mounting.

Write for Bulletin 2510W. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

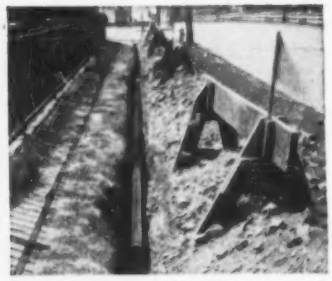
SQUARE D COMPANY

1903 • 50 YEARS OF DESIGN LEADERSHIP • 1953

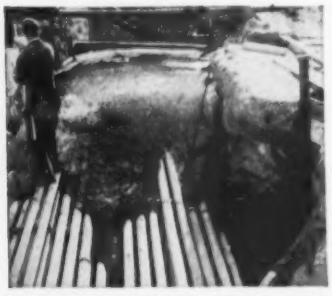


Transite® Ducts cut cable subway costs—

give greater cable protection



Transite Conduit is the thicker walled duct which is used for exposed work or is laid directly in earth without a concrete encasement. Saves time, labor and materials on the job



Transite Korduct® is the thinner walled duct for installation in concrete. Inasmuch as it is used principally for hi-voltage lines, its high thermal conductivity reduces operating losses.

● Johns-Manville presents these brochures as a service to public utilities, design engineers, and all other users and planners of cable subway systems. "*Transite Ducts*" shows how improved cable subway protection, installation, maintenance and operational savings may be achieved. "*Transite Ducts, Dimensions and Fittings*" give the necessary dimensional data on all ducts and fittings.

Transite Ducts offer improved cable subway protection. Made of asbestos and cement, Transite cannot burn, smoke, fume or generate explosive gases. Transite confines arc damage and protects adjacent cables against heat and flame. Transite resists corrosive action of soils; is unaffected by electrolysis.

Installation savings result because Transite is strong, light in weight, easy to handle. It comes in long, 10-foot sections, thus, fewer joints are required. Its permanently smooth bore prevents injury to cable either from natural movement or when pulling cable through. Maintenance savings result from the permanent nature of the asbestos cement composition of Transite. It is as durable as stone.

Moreover, operational savings result because cables run cooler due to the high thermal conductivity of Transite Ducts. This also results in prolonged cable insulation life.

For complete details on how Transite Ducts can cut cable subway costs for your system, send for copies of "Transite Ducts," EL-29A and "Dimensions and Fittings," EL-45A. Write to Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

Be Specific!

specify G&W potheads

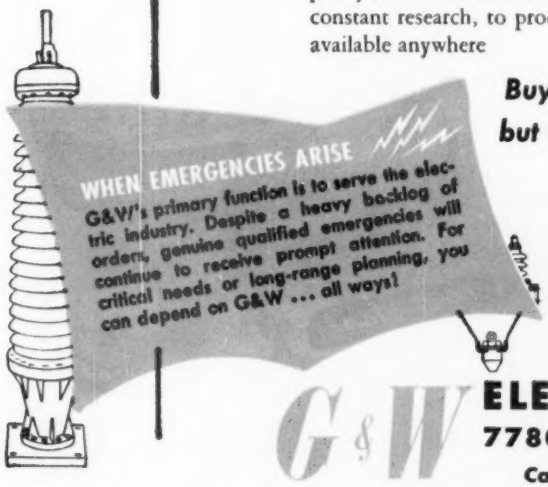
To meet today's exacting requirements for continuity of electric service, it is essential to provide the best possible protection to cable ends. When you specify G&W potheads by name, you help insure trouble-free installations—as G&W users have done for almost 50 years.

G&W Potheads have been the established standard of the industry since 1905, when the company developed the first practical devices for sealing cable ends.

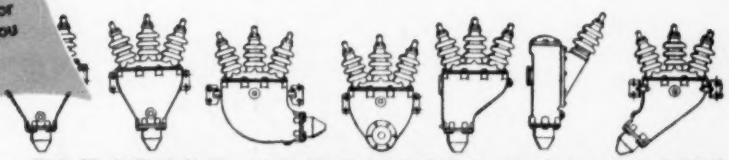
G&W introduced scores of developments which today are taken for granted in the industry. These G&W "firsts" testify to the forward thinking and practical engineering knowledge which have characterized the company since its beginning.

G&W having long maintained close contacts with electric utility, industrial and consulting engineers, and operating personnel, knows the problems in its specialized field, and has the experience needed to solve them.

G&W pioneered in the design and development of equipment for electric cable distribution systems. It is the company's long-standing policy to confine its efforts to this field and to continue, through constant research, to produce the finest equipment of its kind available anywhere


WHEN EMERGENCIES ARISE
G&W's primary function is to serve the electric industry. Despite a heavy backlog of orders, genuine qualified emergencies will continue to receive prompt attention. For critical needs or long-range planning, you can depend on G&W ... all ways!

Buy the high-voltage cable of your choice, but for uninterrupted performance, always be sure to specify G&W POTHEADS



G&W ELECTRIC SPECIALTY COMPANY
7780 DANTE AVENUE, CHICAGO 19, ILLINOIS
Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U.S.A. • In Canada—Powerlite Devices, Ltd., Toronto, Montreal and Vancouver

three tapes
...one quality
GOLD SEAL

FRICTION
Get the most "coverage" for your money with tape that goes *further* . . . say Gold Seal.

RUBBER
Get the splicing compound that sticks fast, speeds the job . . . say Gold Seal.

PLASTIC Get Gold Seal quality in plastic electrical tape. Highly elastic, it "flows" on to cover any surface snugly. Neat, thin wrapping gives all needed dielectric on most jobs. Sticks on — stays on — resists sunlight and weather — defies water, oil, solvents. Single 60 ft. rolls, cellophane protected, are packed in round metal cans. "Tape-saver" 20 ft. rolls, sized to meet average job needs and "swing" easy in tight places, are packed in 10-roll Handy Pack containers. Sample free on request. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

Also Diamond Seal Friction and Rubber Tapes made to ASTM Specifications. Products of Jenkins Bros. — makers of famous Jenkins Valves.

Here's DOUBLE-ACTION

Easier, More Profitable

1.

A NEW EDITION OF "YOUR HOME" BOOKLET

This big, 40-page booklet fully describes and illustrates how effectively Adequate Wiring contributes to truly modern living. Here are dozens of electrical ideas that will help your customers and prospects plan real comfort, convenience and safety into their "dream homes" whether they're building new or remodeling. This booklet will help you convince your customers that it's wiser to do the job right the first time; they'll want to install more, high quality wiring devices. As a result, they'll gain real electrical satisfaction for years to come . . . and you'll gain higher profits with less selling effort.

2.

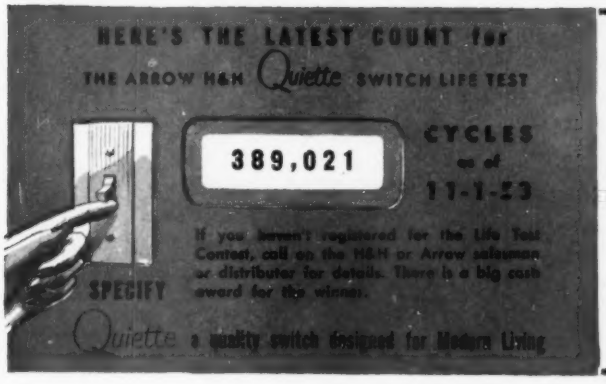
A NEW "PACKAGE PLAN" TO PROMOTE ADEQUATE WIRING

First—the new "Package Plan", included in the "Your Home" Booklet, provides a complete, room-by-room check list for electrical conveniences. This promotes Adequate Wiring by making it easy for your customers to determine their electrical needs accurately . . . and by making it easy for them to explain their needs to you. **Second**—this plan shows the estimated average installed costs for Adequate Wiring in various sizes of homes . . . together with the cost per month over a 20 year period. This promotes Adequate Wiring by demonstrating how very little additional per month it will cost to enjoy a home planned for today's **and** tomorrow's electrical living.

EXTRA COPIES OF "YOUR HOME" WILL WORK AS YOUR SALESMAN

SEND FOR FURTHER INFORMATION TODAY!

WIRING DEVICE H·H ARROW **DIVISIONS**


HERE'S THE LATEST COUNT for
THE ARROW H&H Quiette SWITCH LIFE TEST
389,021
CYCLES
as of
11-1-53
If you haven't registered for the Life Test Contest, call on the H&H or Arrow salesman or distributor for details. There is a big cash award for the winner.
SPECIFY
Quiette a quality switch designed for Modern Living

THE ARROW-HART & HEGEMAN ELECTRIC CO.
103 HAWTHORN ST., HARTFORD 6, CONN.

Please send me the following:

- ☐ *New "YOUR HOME" Booklet.*
- ☐ *"QUIETTE SWITCH" Promotional Folder.*
- ☐ *Information on Extra Copies of "Your Home" Booklet and "Quiette Switch" Folder.*

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NEW

truly functional

TUBECHECKER

by

WESTON

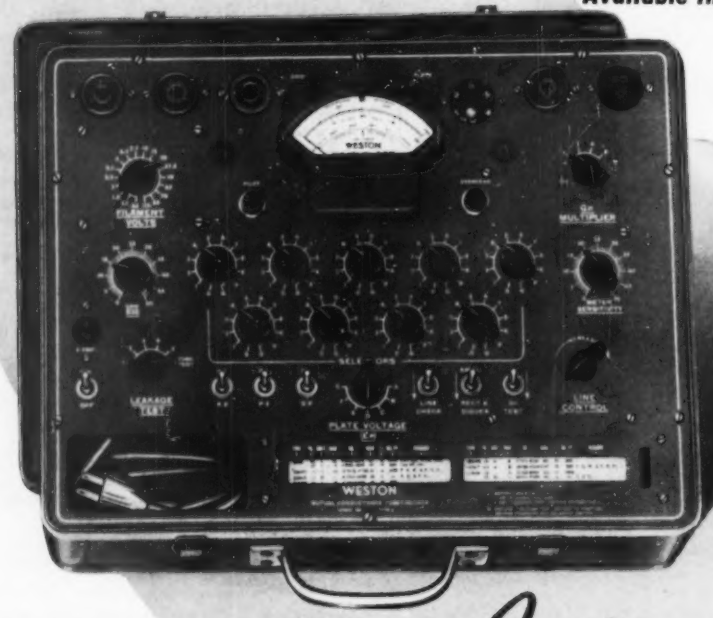
with new features for greater accuracy and time-saving facility in all testing

- Provides accurate meter measurement of leakage resistance as high as 5 megohms between tube elements.
- Permits high transconductance measurements, with ranges 3000/6000/12000/24000 micromhos.
- Multiple switching protects against early obsolescence, allows making any combination of tube connections.
- Element switching permits checking and comparing individual sections of twin-section tubes without changing selector switch.
- Only *one* socket for each type tube base eliminates plugging tubes into wrong sockets.
- Sockets for all type bases . . . including acorn and 7 and 8 pin subminiatures.
- 19 filament voltage settings—.65 to 115 volts. 5 plate voltages — 20 to 177 volts. A 45-volt source for testing subminiature types.
- Grid bias, plate voltage and meter sensitivity adjustable.
- Large, readable fan-shaped meter . . . new roll chart with complete, up-to-date data on all tubes.

Complete data on the new Model 981 Type 2 available in bulletin form. Write . . . WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

5539

Available through leading distributors



WESTON
Model 981 Type 2

WESTON *Instruments*

abreast of the trend in industrial power transmission

...SPRINGS MILLS selects HAZARD self-supporting cable

From main substation, Hazard self-supporting cables distribute power to the main buildings of Springs Mills plant. Note the neatness and compactness of the installation. Cables are readily accessible for splicing; all-in-one construction makes relocation easy.

SPRINGS Cotton Mills, among the most modern in the textile industry and home of famous Springmaid fabrics, demand the finest when it comes to industrial power transmission. Safety, compactness, ease of installation, appearance and low cost were uppermost considerations in the selection of Hazard self-supporting cable for power distribution at the Springs Plant.

Hazard self-supporting cable is insulated with Watertite heat- and moisture-resistant insulation and protected by Hazard's rugged Hazaprene ZBF sheath. This abrasion-resistant jacket stands up against the destructive conditions common to industrial installations and, in addition, more than meets the requirements of the Federal Bureau of Mines and the Pennsylvania Department of Mines for flame resistance.

Every year, more and more Hazard self-supporting cable is used industrially for safe transmission of large blocks of power in limited spaces and narrow clearances, providing power distribution that is neat and compact and can be relocated with a minimum of effort. Today, investigate the advantages of the "all-in-one" construction (preassembled cable, messenger and binder) of Hazard self-supporting power cable for your particular operation. See your Hazard representative or write . . . Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

HAZARD *insulated cables*

1404

FORGING INDUSTRY application shows typical use of G-E dry-type transformers to change voltage at the load. These Type D's serve heating elements of G-E Roller Hearth Electric Furnace at Fremont, Ohio, plant of Bingham-Herbrand Corporation.

G-E dry-type transformers cut power loss because they change voltage at the load

STRETCH YOUR POWER DOLLARS with G-E dry-type transformers; they can be installed where you need them —at the load. Efficient and economical, G-E dry-types eliminate long runs of costly secondary feeders, reduce wiring costs and cut line losses. That's the way they're helping cut power losses throughout industry. You can use them in your plant wherever machines, lighting or portable tools require voltage changes.

EASILY INSTALLED, G-E dry-types can be mounted out of the way on columns, wall brackets, or platforms. Large wiring compartments do away with need for junction boxes, help reduce installation time.

QUIET IN OPERATION, G-E dry-type transformers are designed for efficient cooling and require virtually no maintenance. Type M's can be used indoors or out, are rated .25 through 15 kva. Type D's, for indoor use, are rated 25 kva and above.

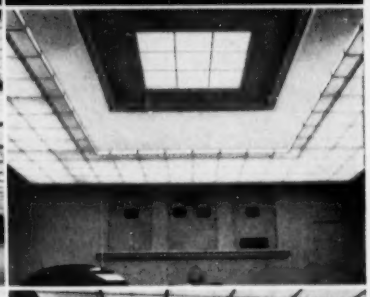
GET FULL INFORMATION on how G-E dry-type transformers can help cut power losses in your plant. Call your nearest authorized G-E Distributor today. Or write for new bulletin, GED-2024 to Section 411-116, General Electric Co., Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

EASY HANDLING is feature of G-E Type M's like this one in Multi-Slide Machine made by U.S. Tool Co., Ampere, N. J.

when the finest in lighting is installed...

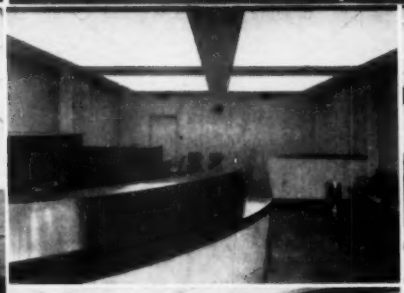


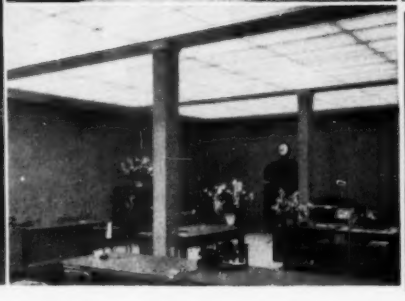
Installations like these the country over vary greatly as to size, pattern, shielding, intensity and periphery. But they all have these things in common: superb quality of illumination and *ease, simplicity and economy of installation.* That's why electrical contractors the country over are finding in Smithcraft Area Illumination a source of excellent new profits and a source of pride and business-building prestige in the installation of today's finest lighting.

Reading from left to right, starting at top:

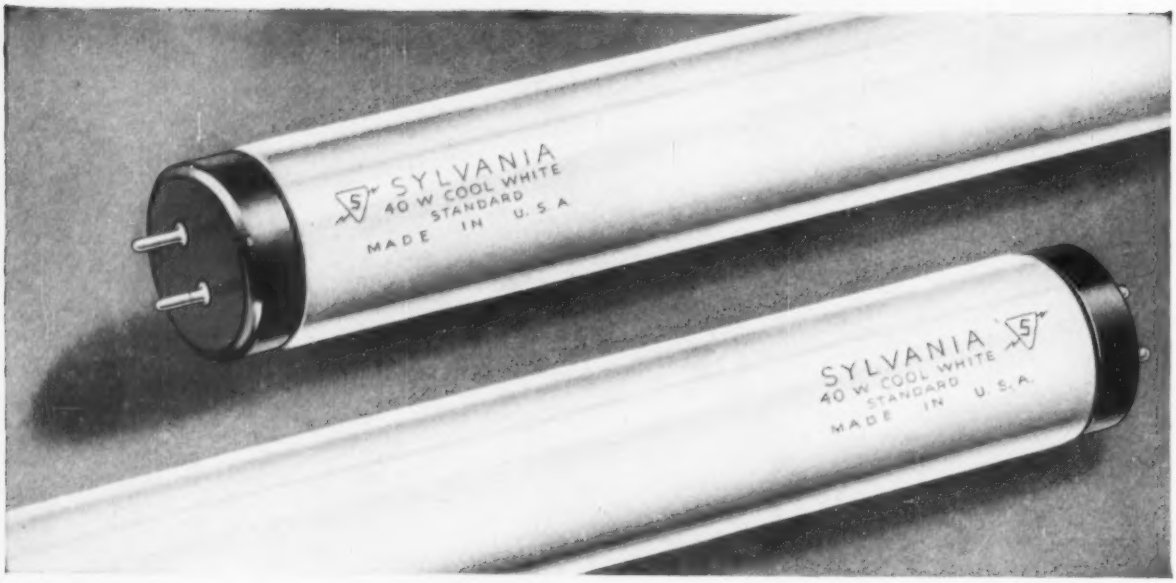
The Mennen Company, Morristown, New Jersey
Owens-Corning Fiberglas Corp., Ashton, Rhode Island
Ford Motor Company, Dearborn, Michigan
Melbourne National Bank, Melbourne, Florida
Niagara Mohawk Power Corp., Syracuse, New York
Rawding Electric Company,
Beaver Falls, Pennsylvania
Texas Eastern Building, Shreveport, Louisiana
Mount Healthy Saving and Loan Company,
—Mt. Healthy, Ohio
Van Huffel Tube Corporation, Warren, Ohio
Florida Power and Light Company, Sanford, Florida

smithcraft **area** *illumination*





Smithcraft
LIGHTING DIVISION
CHELSEA 50, MASSACHUSETTS

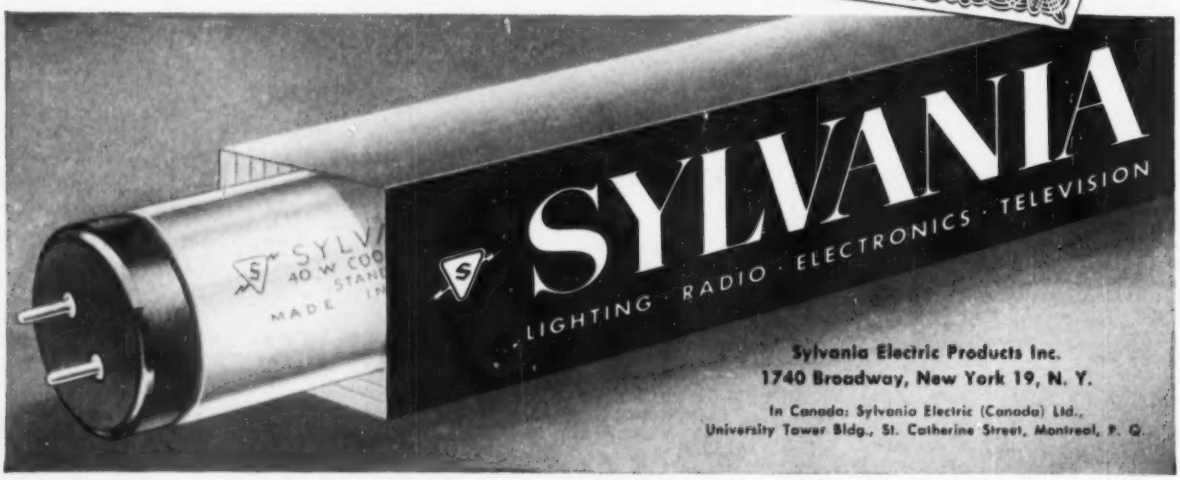


Sylvania offers you the only Guaranteed Fluorescent Lamps!

Sylvania Fluorescent Lamps contain STABILIZED PHOSPHORS . . . an exclusive coating achievement enabling the lamps to now provide a *longer-lasting brightness* than they ever did before. This actually amounts to a "Bonus of Light" worth more than the cost of the lamps themselves. That's why only Sylvania can cover its lamps with this money-back guarantee.

Let us tell you more about this latest Sylvania engineering advancement. For the complete story write Sylvania, Dept. **3L-2112** or call your Sylvania representative.

Try 24 Sylvania Fluorescent Lamps of any popular type. If, in your opinion, they don't give more light and maintain color and brightness for a longer time than any other brand, send them back with your signed Certificate of Assurance and your money will be refunded.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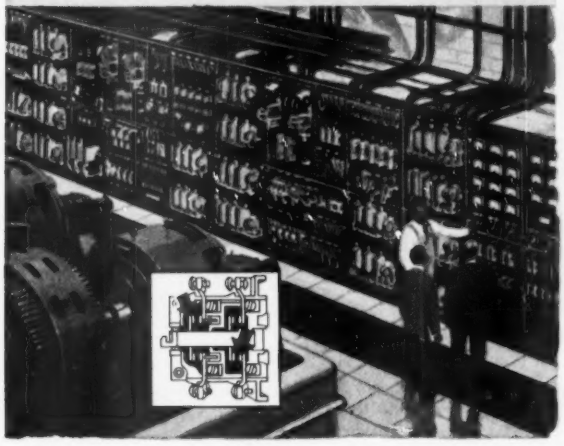
THE THREE CUTLER-HAMMER STARS
★ ★ ★
STAND FOR THREE NEW STANDARDS

Rolling bearing action...

The proper performance and useful life of *all* modern machines demand anti-friction bearings. Motor control is no exception; it too must have good bearings to avoid wear and trouble.

Dust-safe vertical contacts...

Experienced engineers *know* vertical contacts work better and last longer because they stay clean, shed dust, do not collect it. Pressure arc quenching is important new C-H feature.

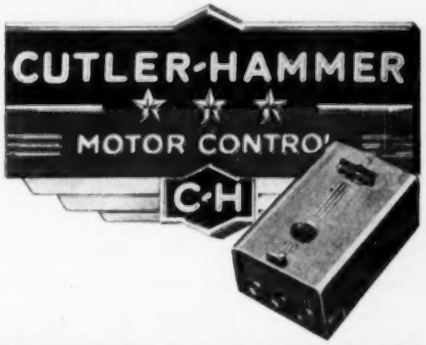


☆ *installs easier*
☆ *works better*
☆ *lasts longer*

Less bounce by the ounce...

Research showed contact bounce caused arcing, that reduced weight in moving contact members cut bounce and arcing. So new light-weight parts now remarkably lengthen contact life.

Cutler-Hammer Motor Control has always been respected for its long life. It has frequently been chosen for industry's "killer" jobs by comparative test. Many users say, "I have never seen a Cutler-Hammer starter wear out." Yet the new Cutler-Hammer ☆☆☆ Motor Control has *three times* the life of the good equipment it replaces! Nearly unbelievable, but it IS true. Now motor control you can install and forget! Try it. Prove it. Your nearby Cutler-Hammer Authorized Distributor is ready to serve you. Order from him today. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.

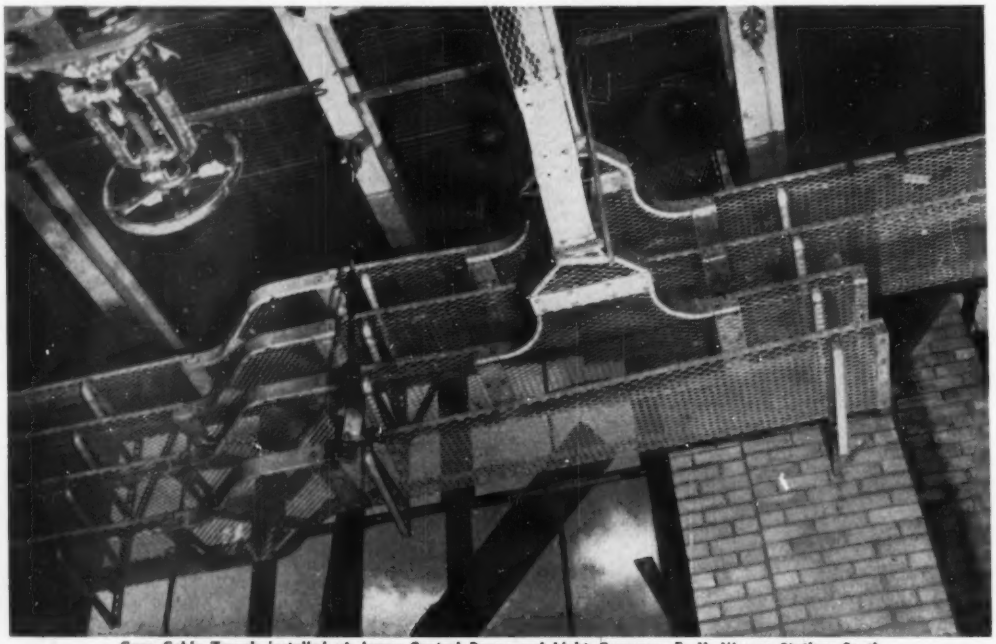


CUTLER-HAMMER ★★★ MOTOR CONTROL

T. J. COPE, INC.

711 SOUTH 50TH STREET, PHILADELPHIA 43, PA.

Standard systems of trough and fittings for supporting power and control cable.
— For over 65 years, Manufacturers of Tools and Equipment for
Installation of Underground and Overhead Electric Cables



Cope Cable Trough installed at Jersey Central Power and Light Company, E. H. Werner Station, South Amboy, New Jersey, Burns and Roe, Engineers and Constructors; Hatzel and Buehler, Electrical Contractors.

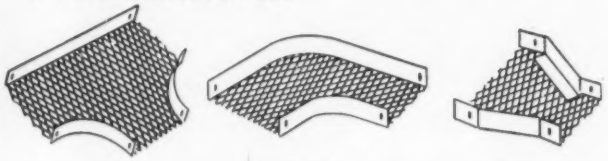
The Cope Standardized System of Cable Trough offers a simple, sturdy, time and labor saving construction for the support of electrical power and control cable. It is widely accepted by leading engineers and contractors as is indicated by an impressive list of outstanding installations.

Practically any layout problem can be met. Sturdy raceways of varying widths, at different levels and in any direction are easily installed. They can pass around, over or under obstructions and change from one size trough to another. For very unusual conditions, special fittings can be designed and fabricated.

Standard straight trough is in 8′ lengths and in 6″, 12″, 18″, and 24″ widths. All are 3″ high including steel binding strip. Covers are also available. Assembly requires only the use of nuts and bolts which are supplied. All parts are hot dip galvanized. Write for Bulletin 65A for full details.

COPE STANDARD FITTINGS

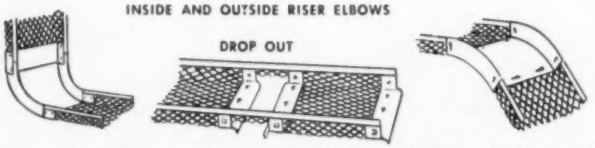
. . . in the Horizontal Plane



TEE ELBOW REDUCER

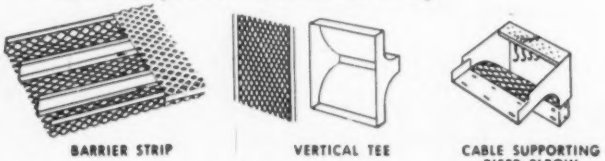
All fittings have radius corners to protect the cable from damage during installation and insure a neat finished job.

. . . in the Vertical Plane



Changes of direction or elevation are easily made with these and other standard fittings shown in Bulletin 65A. Write for it.

. . . Barrier Strips and Miscellaneous Fittings



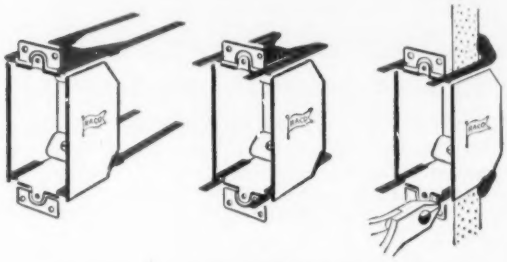
BARRIER STRIP VERTICAL TEE CABLE SUPPORTING RISER ELBOW

You can always rely on RACO

Save Time! Save Money!

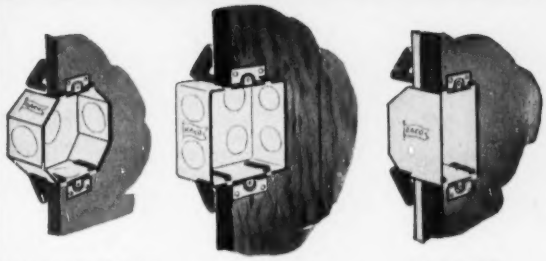
INSTALL A RACO BOX IN 47 SECONDS

HERE IS HOW IT WORKS

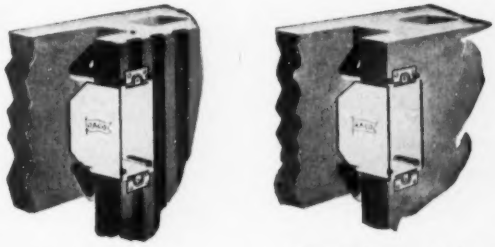


YOUR MEN WILL LIKE RACO BOX GRIPPERS

Raco Grippers are so easy to use! Just lay gripper on box . . . bend lugs over end of box and bend tabs forward. Insert box. Pull tabs up snug. Box is solidly and permanently fastened to any type of wall! Use Raco Box Grippers on any single or multiple wall box.



WALLBOARD WOOD PLASTER



TILE CONCRETE BLOCK

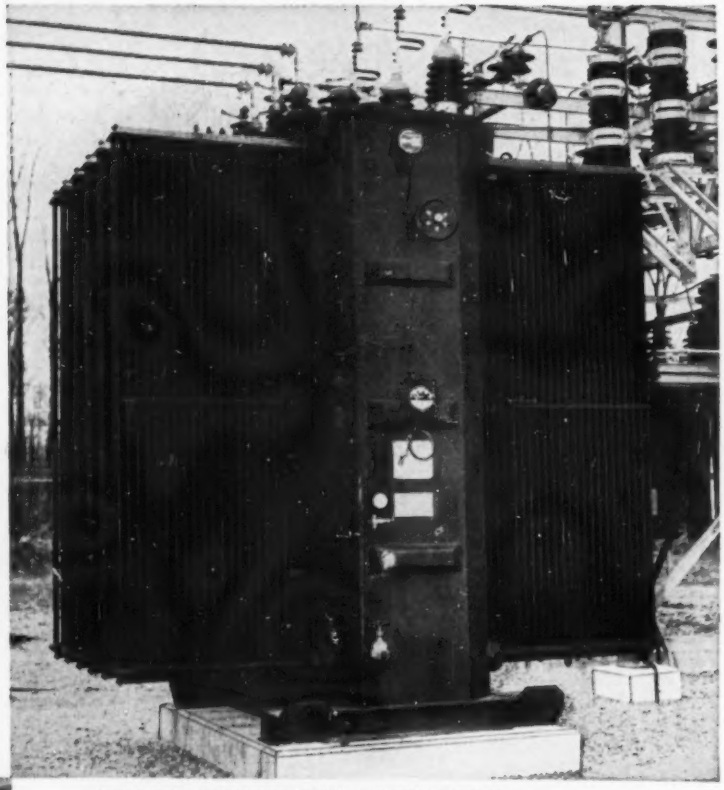
WRITE TODAY—Get Complete Information on RACO Box Grippers

"A BOX FOR EVERY NEED"

ALL-STEEL EQUIPMENT INC. • Aurora, Illinois

Wagner

Transformers used by Studebaker in new power distribution system planned for present and future needs



6000 KVA WAGNER POWER TRANSFORMER where power is received at 26.4 kv and is stepped down to 13.2 kv for distribution to the seven unit substations in the plant.

1000 KVA WAGNER UNIT SUBSTATION TRANSFORMER, at one of the five load centers that deliver 440 volt, three phase power to large machines and equipment.

New Jersey plant can convert from military to auto assembly production without extensive system changes!

The modern power distribution system at the Studebaker Corporation plant at New Brunswick, New Jersey has been planned with an eye to the future. While the plant is now manufacturing military jet engine parts, it will eventually become eastern auto assembly headquarters for Studebaker.

The power load is divided between seven load center substations, all equipped with Wagner Unit Substation Transformers, spaced 160 feet apart down the center of the building. In addition to insuring an adequate power supply for present purposes, this plan provides a dependable supply of power from short secondary feeders at any time in the future.

* * *

Why not discuss your next transformer installation with the Wagner engineer nearest you? There are Wagner branches in 32 principal cities. Bulletin TU-181 gives full information on Wagner Power Transformers, and Bulletins TU-13 and TU-56 tell about Wagner Unit Substation Transformers. Write for your copies.

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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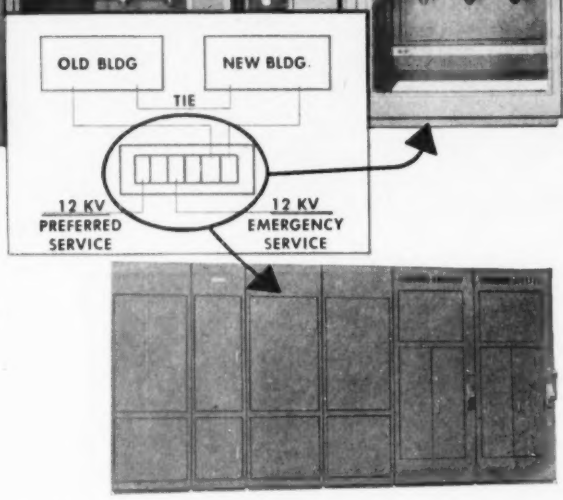
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T53-9



Switchgear at Lower Price Levels

METALCLAD SWITCHGEAR

reduces cost about half for switching centers

When a hospital recently undertook a modernization and expansion program, the enlightened use of this switchgear cut the cost of the switching center in half.

The 6-bay unit was installed to provide preferred and emergency sources of 12,000-volt power (with automatic throwover and return), and metering, plus switching and protection of the outgoing feeders to the load centers in each of two buildings. Secondary circuits are 220-volt 3-phase power, and 120/240 lighting.

The program also involved changing the supply voltage from 4 KV to 12 KV for greater over-all economy.

Scores of installations in a wide variety of industrial plants, public and commercial buildings have demonstrated beyond question that S&C reliability and performance cannot be surpassed . . . and you pay substantially less.

If you are planning a new installation, or have the job of modernizing an old one, don't let specifications leave the drawing board without first finding out how S&C Metalclad Switchgear can save you money.

Nearly always it affords the lowest cost way to a thoroughly reliable switching center or service entrance unit. Write for full information today.

S&C ELECTRIC COMPANY

Formerly Schweitzer & Conrad, Inc.

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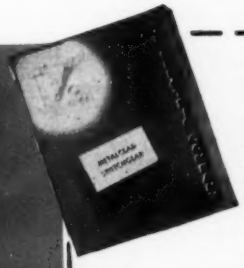
SPECIALISTS IN HIGH-VOLTAGE CIRCUIT INTERRUPTION



S&C Electric Company
4433 Ravenswood Ave., Chicago 40, Illinois

Please send me your new booklet on S&C Metalclad Switchgear. No obligation on my part, of course.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

MOST TREMENDOUS ADVANCE SINCE *Stab-lok*® WAS INTRODUCED

New MAGIC "E" saves space . . . saves time . . . saves money

MORE THAN 15 MILLION STAB-LOKS have been installed in three short years. And now Federal Noark's Magic "E" slots in Stab-lok bus bars *multiply* your opportunities to install Stab-lok and save space, time and money, as well!

The Magic "E" slots and sequenced bussing that are standard in many Stab-lok enclosures are designed to accommodate:

(a)—Single and double pole (simultaneous trip) Stab-loks Type NA;

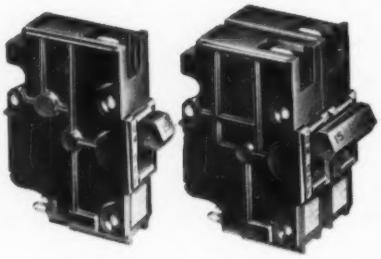
(b)—The new space-saving Stab-lok breakers, Type NC. These new breakers come in 15 and 20 amp. capacities. They are half as wide as the Type NA . . . two NCs can be inserted in place of one NA.

The flexibility and widespread combinations of individual pole breakers thus made possible are simply amazing. In addition, smaller enclosures can be installed with ample capacity for future circuit expansion.

Order Federal Noark Stab-lok from your distributor. And write for the new Magic "E" booklet that gives you the whole story of Stab-lok's tremendous improvement.

Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

STAB-LOK CIRCUIT BREAKERS TYPE NC. One-half inch wide . . . two can be inserted in place of one Type NA. Made in 15 and 20 amp. capacities.



STAB-LOK CIRCUIT BREAKERS TYPE NA. The original Stab-lok. Single and double pole (simultaneous trip). Made in standard range of 15 to 50 amps.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

FEDERAL NOARK®

Washington Report

1953 totals for most business activity will equal or exceed past annual records, in spite of talk of "recession" and "adjustments". This is especially true in fields affecting the electrical industry.

Consider construction, for example. Total construction expenditures, which represent about 13% of "gross national product", will in 1953 set a new record of nearly $35 billion, up about 10% over 1952's record. Recent downturns in certain fields—industrial, housing, farm construction, etc.—have been offset in other activities—commercial, religious, educational, public utilities and highway construction.

Electric power production is now running about 8% ahead of 1952, which exceeded 1951's record by 7%.

Steel output for year will be about 112 million tons, 95% of 117.5 million ton capacity, up 22 million tons over 1952.

So "recession" or "adjustments" are relative, and cutbacks have been mostly in 1953's last quarter as compared with record quarters earlier this year. Some industries have trimmed production to restrain inventory growth, Commerce Dept. reports, and employment is off in some areas in recent weeks, according to Labor Department. It all adds up to mixed trends in the economy, with some industries showing a firmer trend.

1954 outlook is for another good year of business activity, down only slightly from 1953 highs. Dept. of Commerce predicts new construction will total about $34 billion, off 2%. Population is increasing at rate of 2.5 million annually, there are about 1.6 million marriages a year, new households in 1953 were about 920,000, and births are at rate of 4 million a year. Economists in and out of government point to these factors as basis for a growing economy.

Bigger tax write-offs will be authoried to firms constructing defense production facilities when these new plants are located in chronic labor hardship areas so designated by Labor Department, ODM has announced. Labor Dept. currently lists 17 major and 22 smaller areas of this type.

Less red tape for businessmen dealing with Government agencies will be the objective of a proposed Office of Administrative Procedure recently recommended to Eisenhower by a Presidential committee. This new office would make continuous studies and recommendations covering ways of simplifying procedures, and would be a part of the Justice Department. It is expected that Congress will be asked to authorize this office.

Small firms can obtain loans more easily now from the Small Business Administration, it was announced recently by Wendell B. Barnes, acting SBA chief. Applications for financial assistance from retailers, wholesalers, and some other types of business firms will now be considered, as well as from producers of military or civilian goods essential to defense. SBA is the new lending agency which, in effect, replaced the previous Reconstruction Finance Corporation, and limits its loans to so-called "small business".

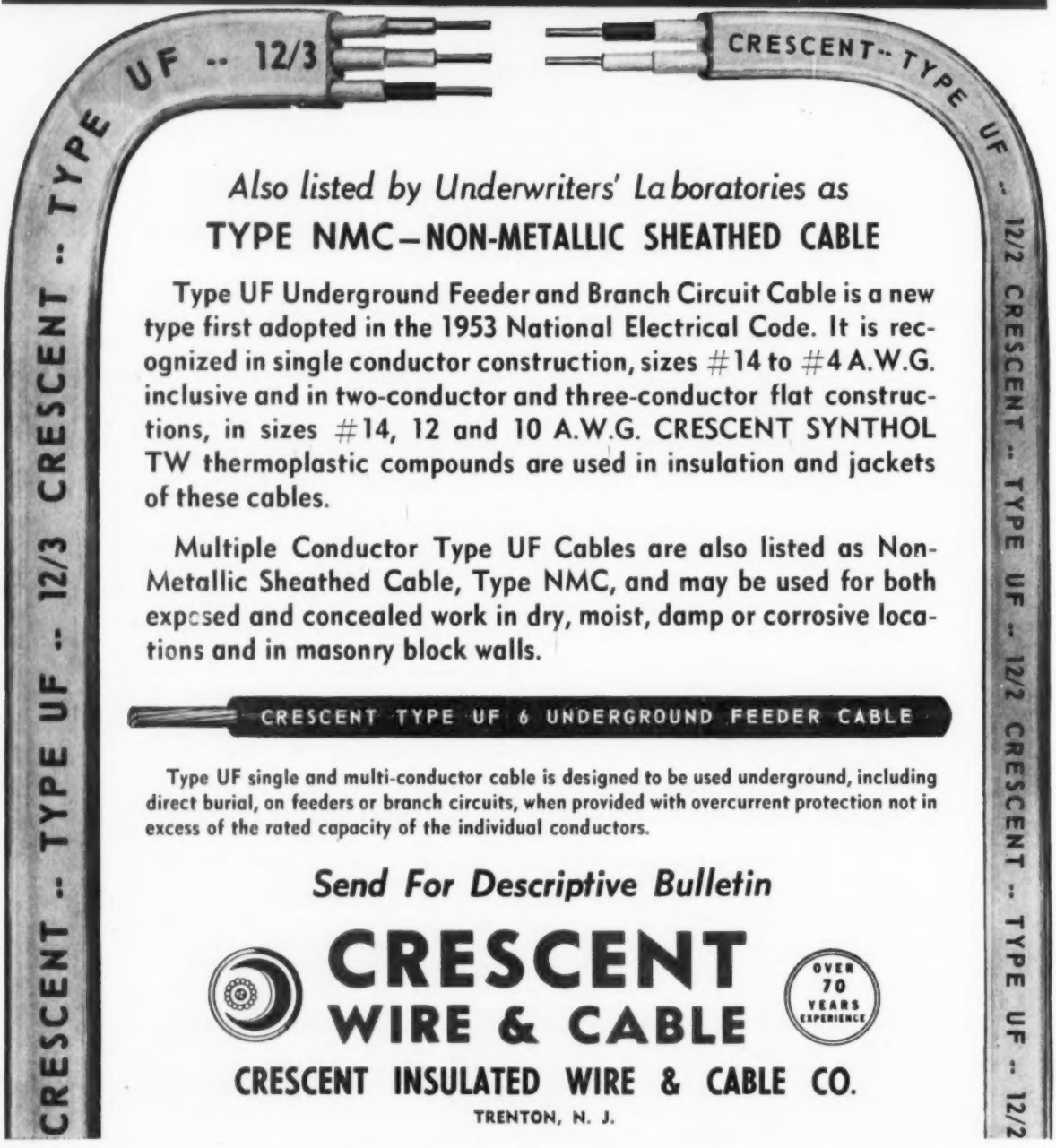
Public housing in 1954 will at least equal the 1953 rate. Public Housing Administration already has contracts with local housing authorities for 33,000 units, in addition to this year's 20,000 approved by Congress. Future of public housing after fiscal 1955 now rests with a 22-man Presidential advisory commission which is expected to propose some sort of long-range housing-subsidy program.

NEW in the 1953 Code

CRESCENT

TYPE UF

UNDERGROUND FEEDER and BRANCH CIRCUIT CABLE



Also listed by Underwriters' Laboratories as

TYPE NMC—NON-METALLIC SHEATHED CABLE

Type UF Underground Feeder and Branch Circuit Cable is a new type first adopted in the 1953 National Electrical Code. It is recognized in single conductor construction, sizes #14 to #4 A.W.G. inclusive and in two-conductor and three-conductor flat constructions, in sizes #14, 12 and 10 A.W.G. CRESCENT SYNTHOL TW thermoplastic compounds are used in insulation and jackets of these cables.

Multiple Conductor Type UF Cables are also listed as Non-Metallic Sheathed Cable, Type NMC, and may be used for both exposed and concealed work in dry, moist, damp or corrosive locations and in masonry block walls.

Type UF single and multi-conductor cable is designed to be used underground, including direct burial, on feeders or branch circuits, when provided with overcurrent protection not in excess of the rated capacity of the individual conductors.

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DECEMBER . . . . *at a Glance*

NECA CONVENTION—Recent conventions of the National Electrical Contractors Association have been growing in attendance to the point where few cities have the facilities to handle the group. But Miami Beach's row of ocean front hotels absorbed this year's 1700 plus comfortably.

Meetings were notably well attended by an attentive audience. The program was carried out in a manner which evidenced careful and expert committee and staff preparation.

Highlights of the convention program are covered in the report which leads off the feature section this month, beginning on page 69.

AIRPORT WIRING—The electrical system design of Newark's new air terminal had the advantage of the long experience of Port of New York Authority engineers in the design and operation of large air terminal facilities. (Besides Newark, the P.N.Y.A. operates Teterboro, LaGuardia and Idlewild.)

The Newark installation features include dual power supply, remote control on all important equipment, automatic emergency power, thorough grounding and extensive public address and telephone facilities. Lightning Electric Company of Newark handled the job. Industrial Editor Hugh Scott prepared the story, "Power for an Airport", which begins on page 78.

SHOPPING CENTER—Among modern construction developments, one of the newest and most widespread is the suburban shopping center. Located at or near main traffic arteries, they bring elaborate and extensive modern merchantile facilities to the suburban dweller.

The suburban shopping center presents many unusual electrical system problems as a result of its extensive area and heavy lighting and air conditioning loads. F. R. Roubik of G.E. has prepared for us a discussion of some of these design layout and equipment problems in "Electrical Planning for Shopping Centers," beginning on page 85.

SYMBOLS—The clarity and usefulness of electrical plans are frequently hampered by the lack of adequate, generally recognized, symbolic notation. The rapid growth in the variety of electrical devices and equipment has run far ahead of the conventional accepted symbol tables.

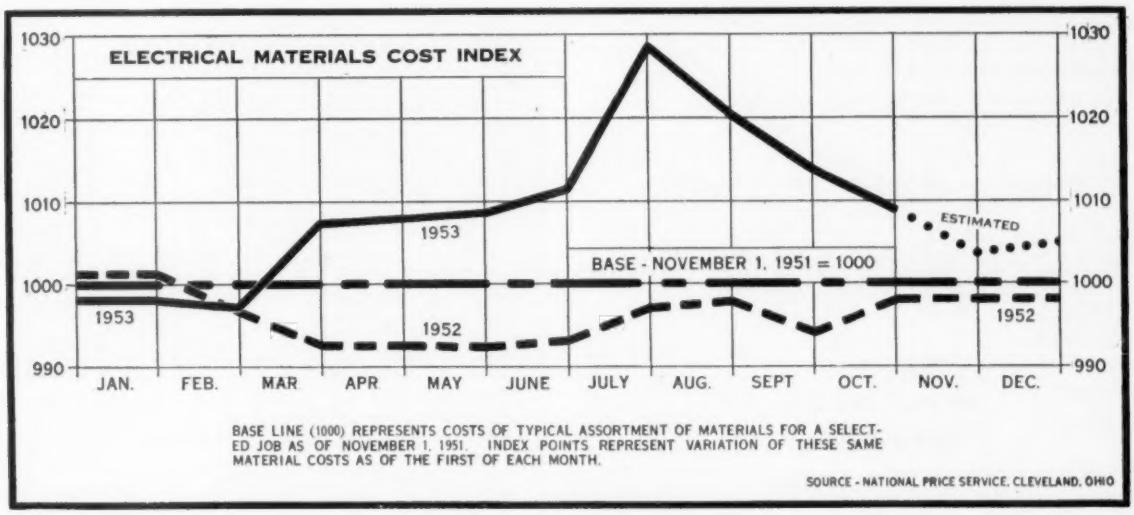
An electrical industry task group in Chicago tackled the problem in cooperation with other crafts and has come forth with a proposed symbol schedule to bring plan notation up to the requirements of current electrical installation practice. The task force was headed by A. C. McWilliams, chairman of the Codes and Standards Committee of the Electrical Contractors Association of the City of Chicago.

The proposed standard symbols are presented (page 90) to allow for the widest industry discussion. It is hoped that they will exentually be adopted as a revision of the present ASA Standard Y 32.9.

CRISIS IN CAPACITY—The tremendous growth of loads in commercial and apartment buildings, especially in the big cities, is reaching a crisis which is requiring actual limitations on the use of electrical equipment.

The problem is not only prevalent in old buildings. Some more recent structures have been caught by the load growth curve with wiring systems already threatened with serious overloading.

New York's Consolidated Edison Company is launching an areawide attack on the problem, designed not only to encourage the rewiring of existing buildings, but to upgrade system capacity in new buildings in the planning stage in order to avoid early electrical obsolescence. A report on the new program is presented on page 94.

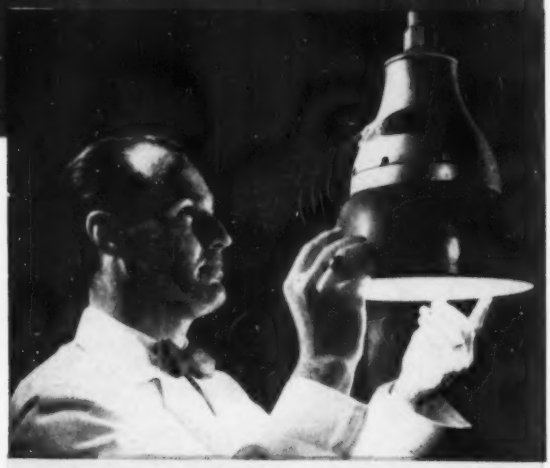


BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

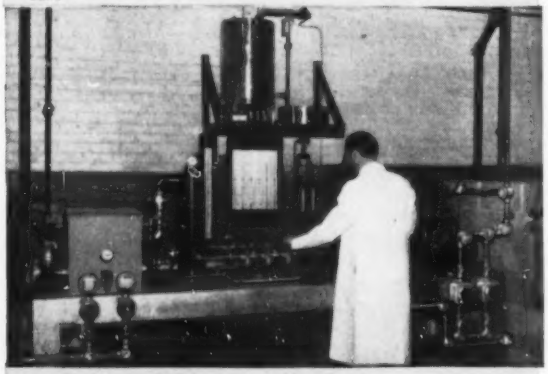
SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

Rigid testing of *Explosion-Proof* CONDULETS*

assures safety and long dependable service



Probing for maximum exterior operating temperature on a Type EVA Explosion-Proof Lighting Fixture using a multiple point recording potentiometer.



Adjusting carburetors and flow meters to create a predetermined explosive mixture within an explosion-proof Condulet for an explosion test.

Photographing the pressure wave in the Oscilloscope to determine the maximum explosion pressure within an explosion-proof Condulet that is behind the concrete wall.

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Laboratory testing is one of the key operations in the production of electrical equipment of the highest quality. Crouse-Hinds laboratories are equipped with the latest scientific instruments and staffed with expert technicians.

Products are constantly tested to make sure that they are being made to withstand field conditions. New devices are tested to predetermine their meeting or surpassing the requirements of Underwriters' Laboratories.

The photographs at the right show three of the many testing operations that are done in the Electrical Laboratory. It is equipped with apparatus for making both alternating and direct current tests, heat tests, pressure tests and many others.

Close cooperation between Crouse-Hinds laboratories and manufacturing departments is one of the reasons why Condulets have been the "Standard of Quality" for nearly fifty years.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

53rd Year—DECEMBER • 1953

March of Control

CONTROL ENGINEERS are involved these days in a relatively new aspect of control application. They talk of "closing the loop" and "feed back". This new dimension of control is marching rapidly out of the rarefied atmosphere of the laboratory into practical industrial use.

TO TRACK THE MATHEMATICS of some of the wondrous new control systems takes recent study at advanced educational levels. A large proportion of existing applications are custom engineered in every detail. But eventually more of the elements will be available in the form of standardized components applicable to a variety of control problems.

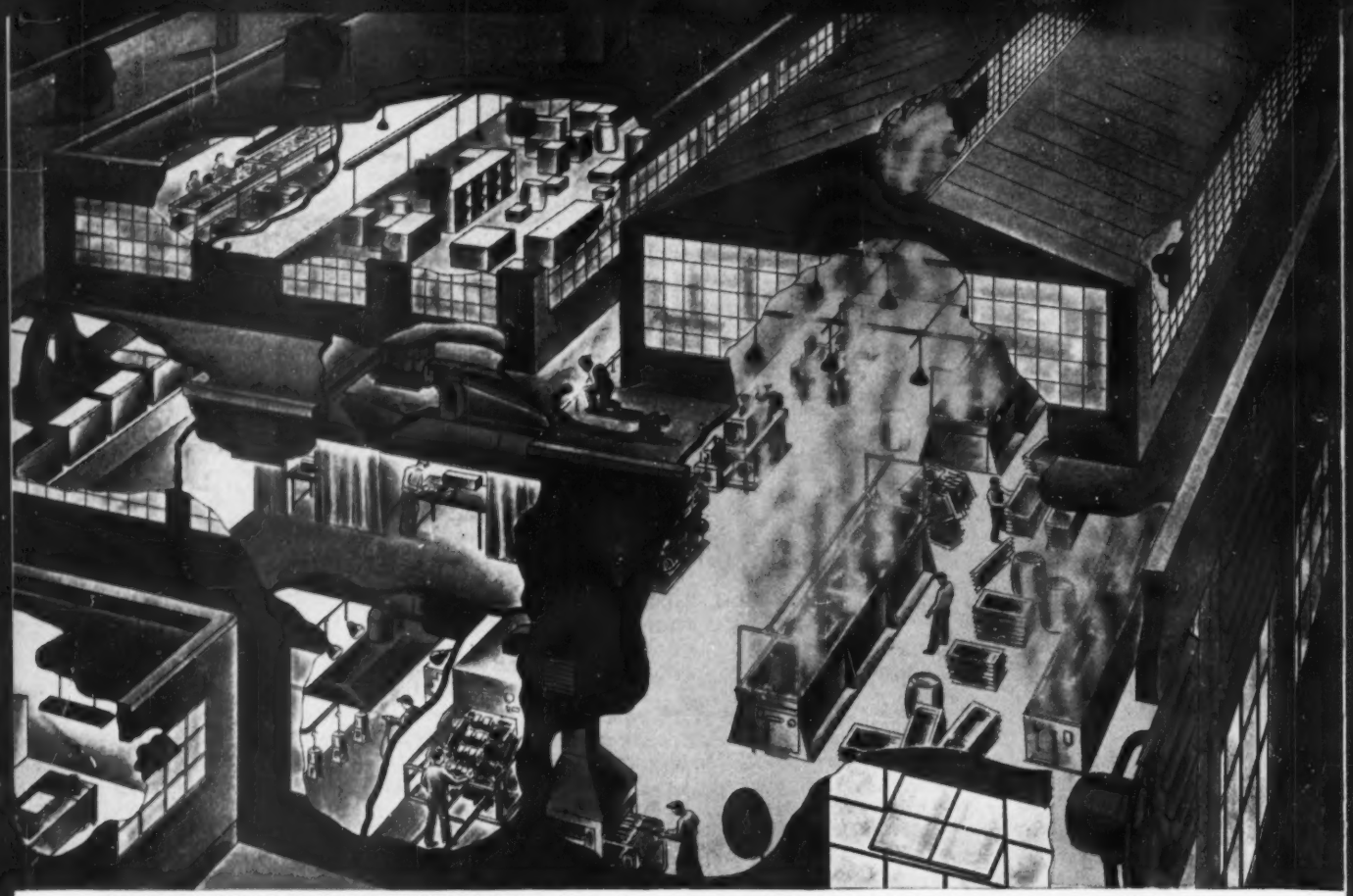
A SYSTEM WHICH MODIFIES or adjusts power input in terms of some essential characteristic of the process forms a closed loop control. A desired characteristic like tension, thickness, pressure or speed is continuously measured. Any deviation is detected and the signal used to correct the speed or other characteristics of the drive. By amplifying the error signal, fine precision can be attained even with powerful drives.

BETWEEN THE ADVANCED CONTROL SYSTEM like the automatic aircraft pilot and elementary systems like the residential heating plant, is a large and virtually unexplored area for the development and application of closed loop control. Almost any process or task requiring precision, close observation or routine guidance is a logical target for study.

THE IMPLICATION OF CLOSED LOOP CONTROL developments is of vital importance to those whose job it is to install and to maintain electrical systems. A tension controlled feed back take-up reel drive, for example, is hardly comparable to a conventional motor and starter of equivalent power. The distinction is of immediate practical importance to the estimator and the job superintendent. And a distribution system designed around the relatively uncritical voltage requirements of conventional polyphase induction motor loads may be impractical when it must supply an array of sensitive closed loop drives and their associated control components.

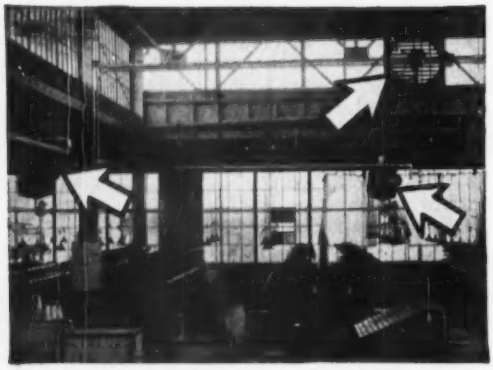
THE PRACTICAL AREAS for closed loop control are at present limited by the specialized engineering design that applications usually require. It is only a matter of time, however, before such systems become familiar elements in electrical installation and maintenance. The closed loop control is a significant symptom of the growing scope and responsibility of our industry.

Wm. T. Stuart



ILG UNITS FOR EVERY VENTILATION NEED. Portable floor fans for spot cooling . . . circulators and window ventilators for offices . . . self-cooled propeller fans and universal blowers for large-volume circulation – there's a standard ILG unit designed to provide efficient flow of cool, refreshing air wherever it's needed. And, you'll find them *all* conveniently available through your nearby Graybar office.

Put fresh air to work for your customers



Unit heaters, infra-red drying units, and accessories, too, are distributed by Graybar. Combined with an efficient ventilating system, you can provide for even heat distribution during cold weather. Your Graybar representative will be glad to furnish accurate information to help you prepare bids and work out practical job time tables.

You can make your customers' plant a healthier, more comfortable place to work through adequate ventilation. Removing fumes, heat, dust, and stuffy air with efficient ILG ventilating units, cuts worker fatigue . . . reduces costly accidents and material spoilage . . . speeds production all around.

Graybar-distributed ILG fans and blowers are the best-designed and best-built units you can provide. Call your nearest Graybar office for free survey help on any ventilation job—we'll be glad to work with you and your customer in the selection of the ILG equipment best suited for individual requirements.

Remember, Graybar is an all-inclusive source for everything electrical. We distribute over 100,000 electrical items for wiring, lighting, communication, power as well as ventilation. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, New York 17, N. Y.*

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Call Graybar first for...

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IN OVER 100 PRINCIPAL CITIES

D. B. Clayton, Sr., Electric Constructors, Inc., Birmingham, Ala. and president, NECA,; Dan W. Tracy, president IBEW, Washington, D. C.; and Paul M. Geary, executive vice president, NECA, Washington, D. C.

NECA District Vice Presidents elected at the Miami Beach Convention are: (L to R) Fred J. Oertli (Dist. 7), St. Louis, Mo., Alfred V. Bartlett, Sr., (Dist. 1), Providence, R. I., C. W. Moseley (Dist. 3), Charlotte, N. C., H. J. Hill (Dist. 5), Wichita, Kansas.

NECA CONVENTION AT MIAMI BEACH

Progress reported on governmental affairs—news on labor relations, employees' benefit program and codes and standards—new plan announced to finance national advertising for NECA Business Development Program—need cited for more intensified apprentice training program—Clayton reelected president—Erne Carlson receives McGraw Award.

Harold A. Webster, T. Frederick Jackson, Inc., New York City, presented the Contractors Medal to Erne C. Carlson, Carlson Electric Company, Youngstown, Ohio.

MORE than 1,700 electrical contractors and their guests converged on Miami Beach, Florida, Nov. 16th to attend the 52nd Anniversary Convention of the National Electrical Contractors Association. Delegates heard NECA Committees propound the conference theme, "Serve the Public and Prosper," during three days of general sessions.

At the opening meeting, president D. B. Clayton, Sr., of Birmingham, Alabama, directed the contractors' attention to the field of electrical modernization and emphasized the convention objective of projecting industry thinking and activity into customer and service relations. No business can continue to succeed unless it operates in the public interest, he noted. That means a reappraisal and redirection of activities to adequately serve the homeowner, storekeeper, small industrials and others whose electrical systems have become obsolete and overloaded during the past decade while construction activity was concentrated on war and defense projects and industrial expansion programs. "The electrical contracting industry regards it as an obligation to the public . . . to provide the many advisory, engineering, procuring and installation services necessary to bring electrical installations up to at least a safe and reasonably efficient level. It is our duty to tell the public what is needed . . . It is foolhardy, bad business and, indeed, dangerous for people to keep on buying electrical equipment when their basic electrical systems will not support the added load", he noted, citing heavy residential appliances and air conditioning equipment as examples. By devoting all their time to competitive new construction work, electrical contractors have lost—by default—this other work which could have been aggressively sold, he added.

Mr. Clayton stated that last year 57.9% of the gross labor payrolls to members of IBEW was paid by NECA members; that this year member contractors are employing 117,841 IBEW electricians—the largest number ever. He advocated passage of the Federal Construction Contract Bill (S.848, H.R.1825) as a public interest measure to eliminate the destructive bid peddling and shopping practices among general contractors. This bill will be placed before the second session of the 83rd Congress in January 1954.

LEFT TO RIGHT—A. C. McWilliams, McWilliams Electric Co, Inc., Chicago; S. R. Todd, IAEI, Chicago; Charles L. Smith, NFPA, Chicago . . . . D. S. Harvey, Harvey Electric Co., Mo., Bill Sadler, Shelley Electric Co., both from Kansas City, Mo. . . . . T. E. Satchwell, Jr., Satchwell Electric Construction Co., Inc., Jacksonville, Fla.; O'Neal Mattox, Jacksonville, Fla.; and J. A. Scheffer, Manager, Greater Kansas City Chapter, NECA, Kansas City, Mo.

LEFT TO RIGHT—P. T. Vail, IBEW, Baltimore, Md.; L. E. Noone, Noone Electric Co., Inc., Baltimore, Md.; J. A. Beck, The Eastern Electric Co., Baltimore, Md. . . . . Robert Moser, Moser Electric Co., Ft. Worth, Texas; C. E. "Bud" Wann, Manager, North Texas Chapter NECA, Ft. Worth, Texas . . . . C. P. Wachtel, Ferguson Electric Construction Co., Inc., Buffalo, N. Y., C. J. Rohrer, Rohrer Electric Co., Inc., Niagara Falls, N. Y., and Merrill E. Neff, Neff Electric Co., Niagara Falls, N. Y.

The progress made by the National Electrical Contractors Association over the past year was outlined in comprehensive reports submitted by secretary-treasurer Clint J. Harder and executive vice president Paul M. Geary. NECA now has a membership (as of Sept. 30) of 3,279 contractors—a net gain of 166 over last year (357 new members less 191 old members dropped). Of this total, 3,156 are in 106 Chapters; 123 are individual members. Two new chapters were added this year.

Need More Apprentices

The need for a more intensified apprentice training program was reflected in the report of Fred J. Oertli, St. Louis, chairman, National Joint Committee on Apprenticeship and Training. Some electrical contractors, according to Oertli, are reluctant to participate in the Business Development Program because they fear a dearth of skilled labor.

Briefly, this is the status of the program to date: In 1949 there were 19,000 electrical apprentices registered. Today, Federal Bureau of Apprenticeship records show 14,000 apprentices in about 500 Local Joint Committees. However, Oertli's committee has been able to identify only 223 area JAC's with a total of approximately 9,000 apprentices in training. Almost half of the labor agreements now on file do not provide for Joint Apprenticeship Committees, he noted.

Mr. Oertli urged NECA member cooperation in answering apprenticeship questionnaires and establishment of local committees. He strongly recommended hiring a full-time JAC coordinator in each wage area to expand and strengthen the program. Only through a well established apprenticeship training program can the tradition and skills of the industry be perpetuated, he warned.

What Labor Thinks

"We have learned to walk in each other's shoes," is the way Dan W. Tracy, president, IBEW, characterized the relationship between labor and NECA developed over the years through mutual respect and cooperation. Labor (IBEW with 600,000 members) and management (NECA contractors) have planned and built a program which has resulted in a virtually strikeless industry, he noted. Not once in the past 30 years has a local IBEW union or an electrical contractor violated a decision of the Council on Industrial Relations for the Electrical Construction Industry, he revealed. Joint operation of the National Employees Benefit Board provides security for electricians and makes them more satisfied, competent employees. And the closed shop has brought stability, better workmanship and higher quality installations to the industry, he asserted. Labor likes NECA's legislative and business development programs.

To better serve the public in the future and to meet demands for skilled mechanics, Mr. Tracy urged continued expansion of apprenticeship training and educational programs, a stabilization of the pension fund (contribution by utility and manufacturer employees of IBEW men), and a continuation of the present cooperative relationship between labor and management. The IBEW is urging its members to give a good day's work for a day's pay. Only through higher production can overall costs be kept down, he concluded.

At the conclusion of the session, NECA, through recommendations of its Board of Governors, approved the continuation of the Business Development Program financed by advertising income; conferred honorary member-

E. R. Edenfield, Edenfield Electric, Nashville, Tenn.; J. E. Stone, Western Line Construction Co., Portland, Oregon; C. H. Dennis, Byrd Electric Co., Memphis, Tenn. . . . . H. L. Evans, Nicholas Electric Co., Los Angeles, Calif., Jack Rollins, Los Angeles Chapter . . . . Louis Kalischer, Louis Kalischer, Inc., Brooklyn, N. Y.; F. J. Groleau,, NECA, Washington, D. C., and Louis Freund, New York City.

H. J. Schantz, R. J. Nickles, Inc., Madison Wis.; E. R. Stege, manager, Madison Chapter, NECA, Madison, Wis.; Hollis Cannon, Badger Electric Construction Co., Madison, Wis. . . . . Bud Fowler, Barker-Fowler Electric Co., Lansing, Mich.; Myer Weinstein, Weinstein Electric Company, Flint, Mich. . . . . H. C. Parke, Marine Electrical Construction Corp., Brooklyn, N. Y., John J. Doris, John Doris, Inc., New York City, and J. H. Oehrig, Lindsay-Wright, Inc., New York City.

ship on A. L. Stone of Los Angeles, California.

Committee Panels

The second session of the annual meeting was presided over by District Vice President C. W. Moseley. The Codes and Standards Committee panel was moderated by T. W. Wilmer.

Mr. Wilmer stated that more electrical inspectors are needed, and that inspectors should be better paid in order to attract qualified men to this field. He also outlined other problems facing the committee.

Speaking for the Underwriters' Laboratories, Inc., was Karl Geiges, chief engineer of UL in Chicago, who described the functions of UL. Visual inspection fails to tell much about electrical equipment, he said, which has led to the thorough testing of equipment now being done by Underwriters' Laboratories and other inspection services.

Charles L. Smith, electrical field service engineer for NFPA told the contractors that over 170 people, with interest in safety of things electrical, work on the NEC, and advised that a complete rewriting of the NEC to make it more understandable is now under way.

E. E. Herndon, NECA Codes & Standards Committee member, outlined some of the problems contractors are having with unlabeled electrical equipment, and also discussed NECA's responsibility in recommending sound revisions to the Code.

T. W. Wilmer proposed a Citizens Electrical Safety Committee for each locality, set up separate and distinct from local examining boards, with one representative from each segment of the electrical industry.

Frank G. Camus, president of the North Louisiana (Shreveport) NECA Chapter, urged contractor participation in IAEI activities, especially at the local level.

A. C. McWilliams, chairman of the Codes & Standards Committee, announced that a special committee in the Chicago & Cook County Chapter of NECA has prepared a revised list of graphical electrical symbols on architectural drawings, which has been published in pamphlet form and circulated for comments and suggested changes. It is hoped that this list of symbols, in final corrected form, will be approved and adopted by American Standards Association, Mr. McWilliams stated.

Robert W. McChesney served as moderator for the Research Committee panel.

Richard W. Osborn, Educational Subcommittee chairman, reported courses in preparation on job management, sales engineering, and business administration.

Col. C. P. Bobe, chairman of the St. Louis NECA Chapter Research and Education Committee said that enrollees need assistance on estimating, suggested they be given various gadgets they can use—rules, text books, wire gauges, etc.—to help maintain their interest in the course. He also recommended that each student be given one week's time for a course in illumination at General Electric's Nela Park Lighting Institute.

Milton Minto, chairman of the New York City NECA Chapter Educational Committee reported that it had been found desirable to select an estimator or contractor with several years' experience to conduct their courses. Even then it was decided to have an industry specialist on hand at each meeting who is thoroughly familiar with all problems relating to the subject under consideration at that meeting to help out.

D. B. Clayton, chairman of NECA's Cost Data Subcommittee said that sub-

LEFT TO RIGHT—E. L. Buttner, Scott-Buttner Electric Co., Inc., Oakland, Calif.; A. H. Wilson, Electrical Construction Co., Inc., Washington, D. C.; R. W. McChesney, Harry Alexander, Inc., Washington, D. C.; R. A. Goeller, Hatzel and Buehler, Inc., New York City . . . . Philip N. Keyes, Shelton Electric, Inc., Shelton, Conn., Kenneth Priestley, Eastern Electric Construction Co., Bridgeport, Conn. . . . . J. R. Williams, Lord Electric Co., Pittsburgh, Pa., Orson R. Taylor, Taylor Electric Co., Inc., Toledo, Ohio, and J. M. Hofmann, Lord Electric Co., New York City.

LEFT TO RIGHT—E. B. Defeyter, Power City Electric Co., Spokane, Wash.; Don W. Close, Donald W. Close Co., Seattle, Wash.; R. C. Hughes, R. C. Hughes Electric, Spokane, Wash.; R. L. Wilkinson, manager, Inland Empire Chapter, NECA, Spokane, Wash. . . . . Charles D. Hills, Koontz-Wagner Electric Co., South Bend, Ind.; Charles D. Colip, Colip Brothers Electric, South Bend, Ind. . . . . R. Goold, R. Goold & Son, Stockton, Calif.; Earl Peak, Central Electric Co., San Francisco, Calif.; and Emil J. Weber, Emil J. Weber Electric Co., San Francisco, Calif.

low bids are purely a result of contractors not knowing their costs, and outlined a four point program of his committee as follows: 1) What we need—cost data on job; 2) why we need it—to prevent guesswork in bidding; 3) where we can get it—from members; and 4) how we can get it—through cooperation of all members. This last point is the biggest problem, he said, and pleaded for full member cooperation.

J. E. Mellett, chairman of the Statistics Subcommittee stressed the need for member cooperation in supplying information requested so that reliable statistics covering the full industry can be developed.

Business Development Program

President D. B. Clayton, Sr. opened the Business Development session. H. L. Scott of Corpus Christi, Texas, acted as moderator. He urged the selling of a service—not a simple commodity or product—but a blend of products, labor, purchasing, coordination, creative engineering thought, job management and sound business practice. This, he said, is the story unfolded in national advertising since last March in *Fortune* magazine, *Business Week*, and the *Wall Street Journal* by NECA.

Oliver F. Burnett, Jr., chairman of the Business Development Committee reported on the past year's work and results. He reviewed the schedule of color ads placed in the three national publications, direct mail letters developed for use of members, personalized letters developed by members and local chapters, advertising novelties bearing the NECA Seal which were developed and distributed, decals and foil seals, sales brochures, contract for the NECA Seal heading in telephone classified directories, etc.

Total NECA promotional activity, including local and national, has approximated $500,000 in 1953, Mr. Burnett reported, with 65 chapters using programs keyed to the national effort.

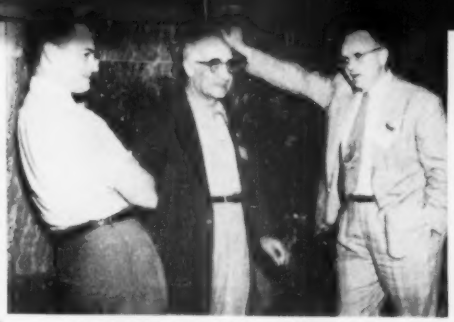
Market Research Manager John L. Rose predicted 1954 will be another good year for building, but a tougher year competitively in which more aggressive and imaginative selling will be demanded.

Lyle N. Foster, Committee vice chairman, told the group that the Business Development Committee has attempted to develop programs and follow policies that combine to make it possible for an electrical contractor to become a real sales factor in the industry. He said that there are two competitive methods of obtaining business: one, bidding on open invitation; two, selling your services.

Pointing out that some contractors have in effect become labor brokers by depending upon the economic power of the IBEW for business, he challenged them to accept the responsibilities of management, to go out and bring in the business by their own effort and with their own resources, with a sales policy based upon good service to the public.

Harry R. Vancott of Los Angeles and moderator Scott reviewed the problems of wholesale trade practices by means of a prepared debate. Vancott presented several proposals including contractor differentials which are frequently suggested. Scott reviewed the legal hazards of such proposals and urged the practical solution of selling the suppliers on the worth of the contractor as the best possible sales element in the suppliers' distribution of electrical materials, equipment and apparatus.

H. R. Wallrath, of General Electric Co.'s Apparatus Sales Division, dis-



Robert Colgan, Rogers Electric Co., Toledo, Ohio; Max Romanoff, Romanoff Electric Co., Toledo, Ohio; E. R. Ismond, Hatfield Electric Co., Cleveland, Ohio . . . . H. I. Tuck, Jr., Tuck and Kendall, Inc., Norfolk, Va.; M. G. Todd, Todd Electric Co., Norfolk, Va. . . . . George A. Gaddis, Gaddis-Walker Electric Co., Oklahoma City, Okla.; Glen O. Pipher, Galloway Electric Co., Oklahoma City, Okla., and Jim McClure, McClure Electric Co., Dallas, Texas.

cussed the NECA Business Development Program "As the Suppliers See It". It is the electrical contractor more than anyone else, he said, who contributes his engineering skill, his ability to mobilize labor, and his sound business judgment to give life and purpose to what would be a meaningless jumble unless the components are put together faithfully and imaginatively on the final installation. The full destiny of the electrical industry can be fulfilled only with the full and constructive participation of the electrical contractor.

Also discussing the Business Development Program from the viewpoint of the suppliers was H. L. Cramer, of Westinghouse Electric Corporation's Agency and Construction Department. Implicit in the NECA program is the promotion of quality in electrical installations, he said. The manufacturer's concept of quality equipment is a parallel to the NECA qualified program which is being so effectively promoted this year.

An effective approach to the architect, the engineer, the industrial plant and other users can be made if the manufacturer and the contractor coordinate their sales plan. There is no conflict between the contractor and the manufacturer in the approach to these customers, he declared. They supplement and support each other. The common goal is to increase the importance of and to upgrade the place of electricity in construction.

NECA's Sales Promotion Manager, P. Howard Farley outlined four necessary steps in making a sale: 1) arousing interest; 2) creating a desire; 3) establishing a preference; and 4) negotiating and closing a sale. The problem is to determine how these four steps can be taken most economically. That is the function of NECA's Public Relations Department, he said. National advertising will be placed in *Saturday Evening Post, Nation's Business, Business Week,* and *Architectural Record.* For local advertising the 1953 NECA Promotion Kit will be continued, with additions. This will be further supplemented by electrical contractor programs sponsored by Sylvania, Anaconda, Westinghouse, and others.

Elections and Resolutions

Don B. Clayton, Sr., was reelected president of NECA. Vice-presidents were also elected for four districts: Alfred V. Bartlett, Sr., Dist. 1; C. W. Moseley, Dist. 3; H. J. Hill, Dist. 5; and Fred J. Oertli, Dist. 7. Other decisions included the dissolution of the IBEW Employers Section and the consolidation of its activities with the general activities of the Association; and the defeat of a proposed reduction in Association dues.

Resolutions considered by the Convention were presented in the report of the Convention Resolutions Committee, E. C. Carter, chairman. A resolution was adopted concerning supply contract clauses, a source of widespread complaint by electrical contractors. NECA denounced the use by suppliers of electrical equipment of obscure, fine-print contract limitations in their acknowledgment of purchase orders. The Association also called on members to give particular attention to all provisions, however obscure, in supply purchase orders and acknowledgments. Another resolution called upon all Chapters to discourage unfair discrimination against "non-resident Qualified Electrical Contractors" in labor agreements or by actions of local unions or joint conference committees, and to eliminate from labor agreements clauses which tend to create different labor costs or conditions for non-resident contractors than for resident contractors with whom they may compete.

In recognition of the growing importance of electrical inspection, the Convention further resolved to act through its Chapters to 1) set up standards of qualifications, both technical and experience, for electrical inspectors, and 2) establish salary schedules commensurate with the duties and responsibilities of electrical inspectors. This resolution carried an expression of willingness of members to pay additional fees to realize the ends set forth.

Other resolutions were: that the Convention call upon NECA Headquarters and the International Office of the IBEW to insure an adequate supply of skilled mechanics; that NECA admonish its Chapters and local unions that a competitive market on electrical work demands more serious consideration of "the public interest" in collective bargaining; that manufacturers be urged to discard the policy of "price in effect at time of shipment" in favor of stable price structures; and that the Association endorse and support the plan of the International Association of Electrical Inspectors to observe an annual National Electrical Week.

McGraw Award

Erne C. Carlson, president, Carlson Electric Company, Youngstown, Ohio, received the Contractor's Medal, James H. McGraw Award for Electrical Men, at the banquet. Harold A. Webster, Industry Member, Awards Committee, made the presentation.

Mr. Carlson received the award in recognition of his enlightened leadership and devotion to the advancement of constructive labor-management relations in the electrical contracting industry.

The panel of judges who recommended Mr. Carlson for this honor consists of: E W. Frazer, H. B. Frazer Electric Company; L. C. MacNutt, MacNutt Electric Company, Inc.; E. J. White, Edward J. White Company; A. Hermann Wilson, Electrical Construction Company, Inc.; and W. T. Stuart, Editor, *Electrical Construction and Maintenance.*

OUTDOOR SUBSTATION, a 3750-kva 3-phase 34.5/4.16 kv unit, now feeds a radial distribution system at the plant. Eventually, a second outdoor sub will be added and distribution changed to loop network.

How a Large Industrial Plant is . . .

"Stepping-Up"

High-voltage in-plant distribution is today the keystone of a three-stage program for the modernization and expansion of the electrical system at Standard Pressed Steel Company, Jenkintown, Pa.

A THREE-STAGE program of electrical expansion and modernization has just about reached the half-way point at the plant of Standard Pressed Steel Company, Jenkintown, Pa. At this plant, a 4160-volt radial distribution system has recently replaced an overloaded and outmoded 440-volt long-line feeder system. The continuing program will eventually provide a 4160-volt loop distribution network offering greater economy, service continuity and increased capacity.

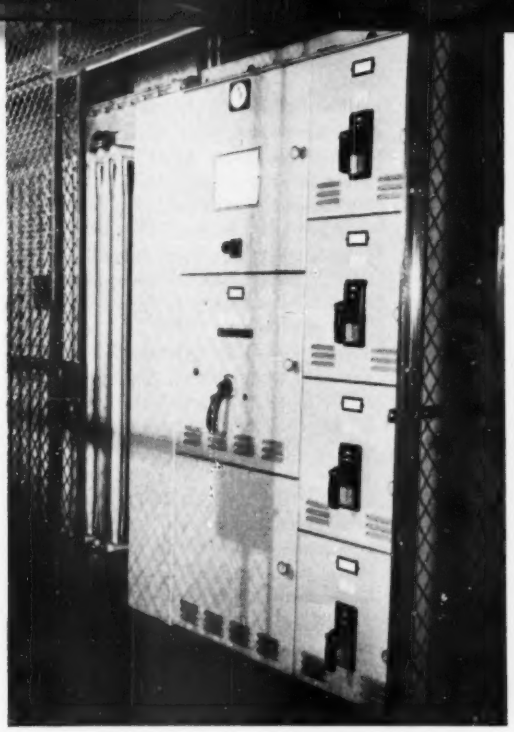
Planning

Standard Pressed Steel, manufacturers of socket head screws, first felt the power pinch on its old distribution system in September of 1951. At that time a plot of future demand showed that projected expansion of production would boost the total plant load to 2600 kva by September of the following year. The existing sub at that time could supply only 2500 kva through three single-phase 33,000/440-volt transformers. In planning a solution to the problem, the possibility of expanding the existing sub was quickly eliminated. Voltages along the plant's long 440-volt lines were already sagging under increased production and to add another transformer would only have increased the already complicated maze of 440-volt lines that fanned out through the plant. Moreover, the company was, at the time, building a new, one-roof plant within and around its existing structure. For these reasons, the old electrical system had to be replaced completely.

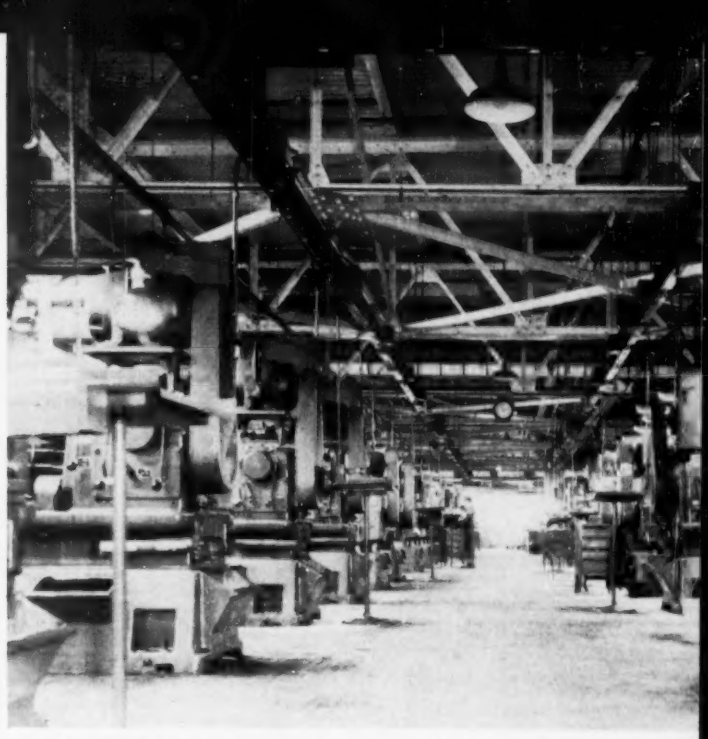
The company decided that it would have the most modern, trouble-free system available, one that would satisfy power needs for years to come. A modern high-voltage network system was selected for the job. This decision, however, was complicated by a shortage of copper and the budgetary need to space the purchasing of its electrical equipment over a period of years.

To make possible the extensive electrical modernization of this plant, the company conceived a program which related cost, electrical continuity during construction and the growing power demand of the plant. This program was reduced to three stages of progress:

(1) Initially, a 4160-volt radial distribution system fed by one 3750-kva



LOAD CENTER, one of six such units spaced throughout production area, steps 4160-volt power down to 480-volts for plant machinery.



BUSWAY RUNS provide the main arteries of 480-volt distribution to production machinery. With plug-in outlets spaced on 2-foot centers busway facilitated changeover to 4160-v distribution.

Electrical Distribution

By B. W. Van Dyke
Plant Engineer
Standard Pressed Steel Company
Jenkintown, Pa.

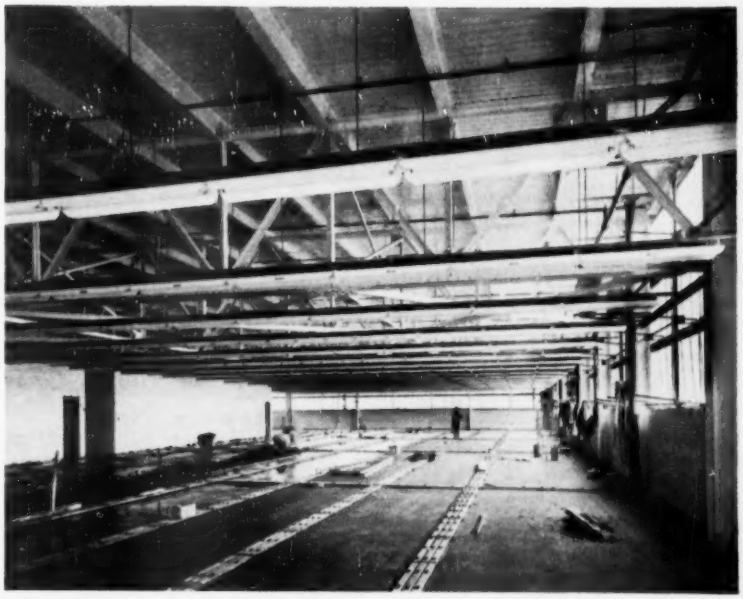
transformer was to be installed to replace the old distribution system. This system went into service in May 1952. Cost: $200,000.

(2) By December of 1953, the job schedule calls for the installation of a second 3750-kva transformer that will double power potential. Cost: $40,000.

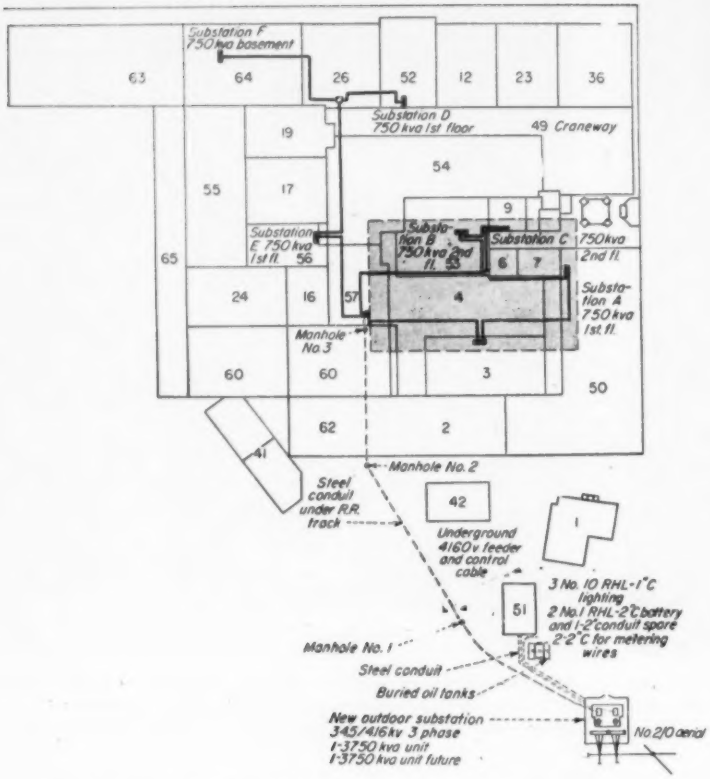
(3) Then, at the earliest opportunity the company will add jump and feeder cables and disconnect switches to convert its radial network to a full loop system of distribution.

Radial System

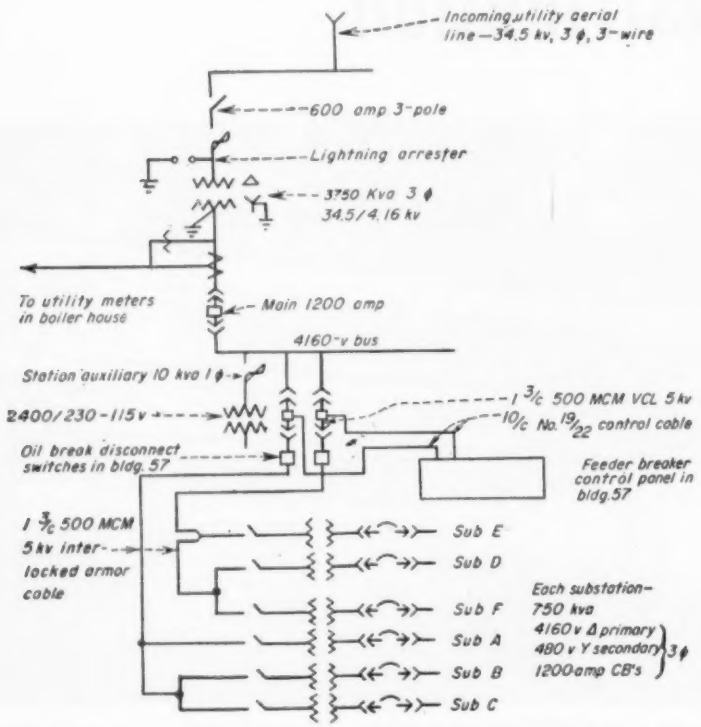
At present, the plant is operating on the 4160-volt radial system. Power is supplied at 34,500 volts, 3-phase, 3-wire from an aerial line of the local utility to one outdoor-type master unit substation. The 3750-kva transformer



LIGHT AND POWER in office areas is served by 110-volt trolley busway feeding fluorescent units and by underfloor duct for 110-volt circuits, telephone and intercom lines.



PLOT PLAN shows layout of electrical system in service, from outdoor sub to load center substations in various plant buildings.



FIRST STAGE of electrical modernization was the installation of this 4160-volt radial system fed by one 3750-kva outdoor sub.

section of the substation is rated at 34,500 volts delta primary, 4160 volts wye secondary, with solidly grounded neutral. The unit is oil insulated and when fan-cooled is capable of operating at 20% overload. The company does not plan to push its unit to that extent, but might be required to do so should installation of its second substation be seriously delayed.

At the outdoor substation, stepped-down 4160-volt power is fed in parallel through feeder breakers to two 1200-ampere feeder cables. These two cables run underground for 700 feet to the plant through a concrete envelope and then overhead via steel conduit to the centrally-located feeder breaker control panel. From this control panel, each of the two 4160-volt cables branches off to feed a radial bank of three 480-volt load centers.

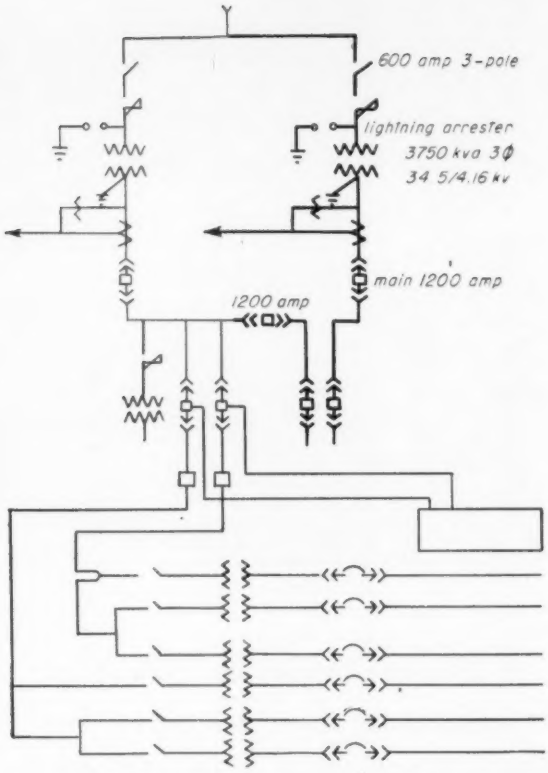
A third cable, a control cable, also runs from the substation to the feeder breaker control panel. This cable permits emergency control of outdoor substation breakers from within the plant. Although it carries only three cables at present, the 700-foot underground concrete envelope has a capacity for eight. This will take care of additional feeder cables for the second and other future substations that may be installed.

When the second substation is installed in December of this year it will be operated initially as a standby unit. As plant load exceeds the capacity of the first unit, the company will probably split the load between its two substations. But at that future date when the full loop system is completed, the company will operate its two substations independently—each feeding a loop of three, possibly more, local load centers. Finally the installation of jump cables and disconnects at the feeder breaker control panel will interconnect the two halves of the system, completing a full loop network.

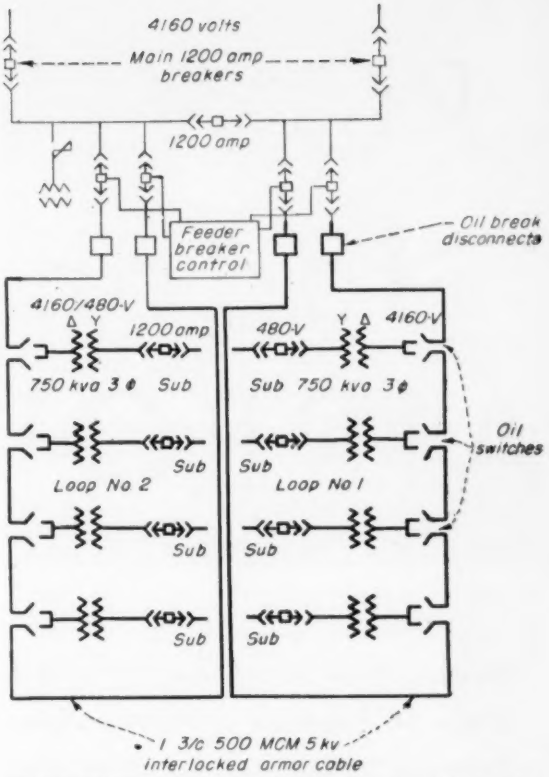
In anticipation of this loop network, all components in main feeders and loops have been sized to carry full plant load. For example, both main 4160-volt feeder cables entering the plant are rated at 1200 amperes. Since peak plant demand at present is 850 amperes, either cable will be able to carry full plant load for some time to come.

Low Voltage

High voltage distribution is terminated at 4160/480-volt local load centers. There are six in service now spaced throughout the plant, but as many as 12 could be hooked into the 4160-volt loops in the future. These 750-kva units have a 4160-volt delta



SECOND STAGE of expansion is the addition of a second outdoor sub tied into the first by a 1200-amp breaker.



THIRD STAGE will complete the project and provide the plant with a 4160-volt loop distribution network.

primary, a 480-volt wye secondary with a solidly grounded neutral. The low-voltage feeder switch-gear sections of these units contain four feeder air circuit breakers—each rated 600 amperes, 600 volts, 25,000 amperes interrupting current. Load centers supply all plant power other than that for emergency stand-by circuits. All machine tools are 480-volt powered and are fed directly from unit load centers by a network of plug-in busway that blankets production areas.

The company selected busway years ago as the most economical and flexible method for area distribution throughout production centers. The network of busway with plug-in outlets conveniently spaced every two feet greatly simplified the recent plant expansion program. Plant engineers estimate that during this period just about every machine tool in the plant was moved at least once without any lost production time. And the presence of this busway network simplified the change to the new high-voltage distribution system—permitting the company to switch in its new distribution network smoothly over one weekend.

Power for fluorescent and incandescent lighting is taken from the 480-volt load centers through separate transformers and lighting panels. In the old installation 440-volt power was stepped down to single phase 110-120 volts through three single phase transformers. Now in a more balanced transformation lighting power is tapped off at each load center through one three phase 440/110-volt transformer. Power is fed in conduit from local lighting panels to overhead lines of trolley busway that feed long rows of fluorescent tubes.

The lighting panels also supply 110-volt power for a few special-purpose tools and for office machinery in administrative areas of the plant. The 110-volt lines in office areas are carried through underfloor ductwork. This criss-cross network of channels also carries telephone and plant intercom wires. Closely spaced openings in the ductwork permit SPS to pull out power or communication lines on two-foot centers throughout its office sections.

System Advantages

Although the electrical modernization at SPS is not complete, the company has already recognized many advantages in the system that now exists. Distribution at 4160 volts instead of 440 has greatly reduced copper loss and improved power factor (up to 98.6% now). Inefficient motor operation and low lighting intensities due to long overloaded 440-volt lines have been completely eliminated. All of these factors have boosted overall economy of operation.

When the second outdoor substation is added and the full loop network completed, further benefits will be derived. The loop network, feeding power in either direction to any point in the network, will provide maximum protection against lost production due to electrical outages. With either of the two outdoor subs capable of carrying full plant load at present demand, double protection will also be provided in the primary system. Together, these factors add up to well-protected service continuity for the plant. And the final system will provide sufficient capacity to meet all predictable needs for many years to come.

This installation represents a case study in modern electrical expansion. It makes clear the advantages of long-range planning in sustaining the cost of an ultimately thorough and adequate electrical system.

POWER for an AIRPORT

By Hugh P. Scott

Newark (New Jersey) Airport celebrates its 25th anniversary by dedicating a new $8½-million terminal building featuring dual power entrances, remote control facilities for all important electrical equipment, automatic provision of emergency power, a thorough grounding system, comprehensive public address and telephone provisions, and a progressive lighting installation. Designed by The Port of New York Authority, this modern structure was wired by the Lightning Electric Service Company.

THE recent completion of a new $8½-million terminal building and $9-million instrument runway has placed the giant airport at Newark, New Jersey, among the nation's finest. The new terminal building measures 576 by 166 feet, has an exterior of two-tone grey brick, an entrance facade of cut granite, and an interior combining marble, chrome trim and huge areas of glass with natural brick, painted acoustical and plastered surfaces, coral terrazzo flooring and an abundance of modern lighting techniques.

In layout, a 500-foot main concourse bisects the structure, flanked on the side nearest the airport by ticket counters and airlines operational offices and, on the opposite side, by ultra-modern air-conditioned retail shops, drug and book stores, barber and bootblack parlors, a bank, snack bar, coffee shop, cocktail lounge and other commercial ventures. Above the ticket counters is the world's longest (500-foot) glass-enclosed observation deck, providing visitors with a dramatic panorama of the busy runways, aprons and loading gates. Also on the second floor level is the main dining room seating 245, airline and administrative offices, electrical and utility rooms.

Power for the terminal is obtained from two separate 2400/4160-volt utility networks (with provisions for a third service entrance if later necessary), feeders entering a transformer vault within the building proper through subway type oil fuse cutouts. Distribution voltage of 120/208 is then delivered to a continuous bus structure by twin 1000-kva 3-phase 4-wire transformers, with network protectors installed on the load side of the tanks.

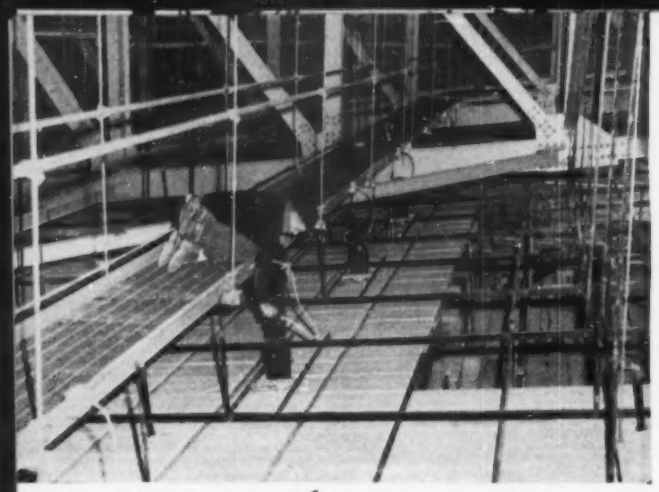
A 5000-amp secondary square copper bus links the transformer vault and the adjacently-located distribution substation, while 3000- and 1600-amp Pringle switches constitute take-offs between this bus and separate leads to switchgear segments. These feeder lines incorporate service switches having fuse ICs of 100,000 amps at full recovery voltage, silver plated hinge and jaw contacts, rotary handles latched closed, and key interlocks for corresponding breakers located at the service end of each distribution bus structure.

These two distribution bus structures, although not connected, are contained in the same continuous switchboard housing—a self-contained metal-enclosed stationary structure fitted with removable air circuit breaker units. Bus bars are mounted on insulated supports, joints are silver plated, lugs for secondary feeders are solderless. Buses and outgoing cable connections are located in a full height rear compartment, while individual breakers are equipped with interlocks arranged to trip automatically when doors are opened or when an attempt is made to remove a unit from its cubicle. Branch breakers are 3-pole 60-amp manually operated assemblies

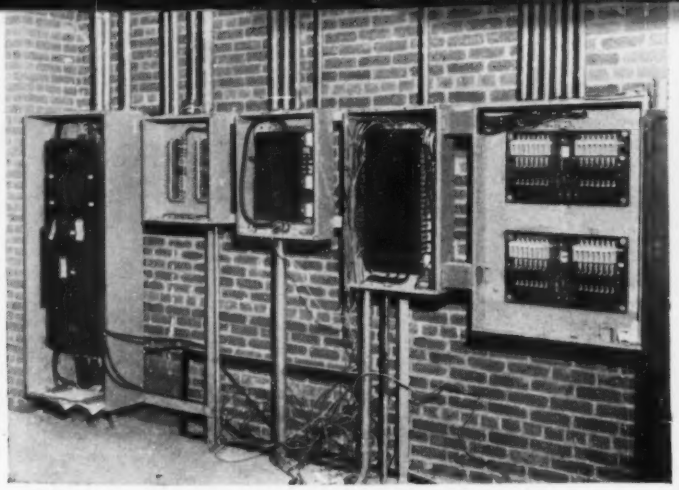
CENTRAL CONCOURSE is flanked on one side by ticket counters and on the other by shops, snack bars and other services. Hundreds of recessed down-lights in the dark-blue high-bay ceiling simulate a star-studded sky, provide 12 footcandles of general illumination. Local lighting is variously functional or decorative, with more than 70 different lighting treatments employed, and with specific-purpose illumination ranging from 30 to 68 footcandles in intensity. Modern dining room, illuminated by a variety of cove treatments, may be seen at far end of concourse at upper level, overlooking both concourse and field.

MAIN ENTRANCE of terminal building has canopy containing 39 recessed PAR-38 projector floodlamps to illuminate the sidewalk, and 22 weatherproof 200-watt floods upturned to light the facade. Aluminum letters of Airport sign are backlighted by cold cathode tubing while area immediately inside entrance is brilliantly illuminated by egg-crate-louvered suspended ceiling. Landscaped islands between roadways contain double-arm tapered elliptical street-lighting standards supporting 400-watt color-corrected mercury-vapor units having narrow asymmetric IES Type 2 distribution patterns.

LUMINOUS CEILINGS, consisting of eggcrate-louvered panels suspended beneath continuous rows of fluorescent lamps, are installed immediately inside the three front entrances. Coves above all shop windows serve to silhouette sign lettering and evenly flood upper corrugated asbestos-cement walls with low-brightness illumination. Coves, as well as backlighting treatments, are used effectively in 3-dimensional advertisements and directories listing services.



CATWALK above suspended ceiling over high-bay concourse provide access to the 500-watt incandescent base-up optical accentlight fixtures for relamping and cleaning purposes. Other areas having lower ceiling heights are illuminated by downlights of lower wattage.



INSTALLATION view of typical switching center shows (left to right) distribution panel for power and light, connection block for remote control system, emergency lighting panel, general lighting control center and remotely-controlled contactors.

PARKING AREA is entered through canopy-spanned toll gates, each traffic lane illuminated from above by two continuous rows of fluorescent fixtures. Luminous sign consists of free-standing metal letters with translucent glass backlighted by cold cathode tubing. Streetlight units are color-corrected mercury-vapor, while additional illumination inside the parking area is provided by batteries of tower-mounted weatherproof floodlights.

with dual magnetic overload attachments. Main breakers are electrically operated, equipped with instantaneous tripping mechanisms.

The 1600-amp section of the switchboard serves major tenants, such as food concessionaires, shops and so forth, together with supply and exhaust fans, air conditioning units and the like for these areas. The 3000-amp section serves an extensive street lighting system, toll booths, parking area, airline offices, the boiler house (with zone heaters, circulating pumps, cooling tower fans, roof vents and boiler feeds), general lighting in the terminal building, and a motor control center that operates air compressors, evaporators, chilled water pumps and refrigeration units.

Automatic Emergency Power

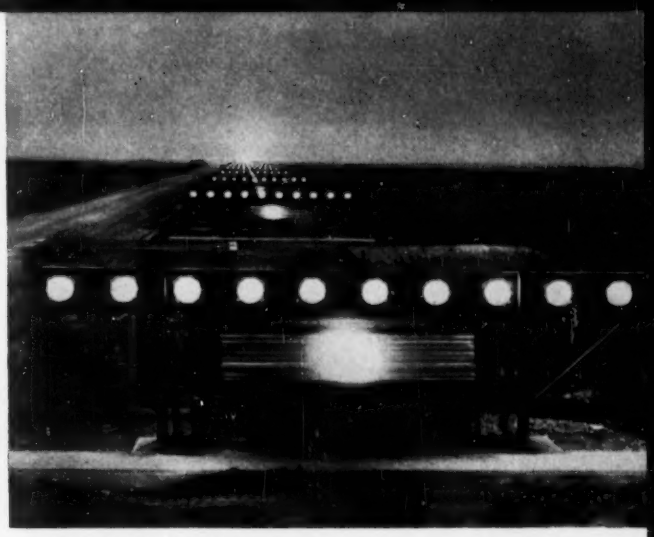
Fundamentally, the distribution system is composed of separate power and lighting networks, with the lighting system further divided into normal and emergency components. This emergency system serves fire alarms, paging facilities and receptacles for essential equipment as well as basic lighting.

Power service is at 208-volts 3-phase 3-wire for motors larger than quarter-horse, and 120-volts 2-wire for smaller units. Normal lighting is via a 120/208-volt 3-phase 4-wire system having a grounded neutral. Emergency lighting is also handled by this system during periods of normal utility service but, in the event of an ac failure, is automatically transferred to a 125-volt dc battery.

The emergency lighting load is connected through an automatic transfer switch which operates in either direction independently of electrical operating mechanisms and control circuits, thereby permitting the load to be transferred to the auxiliary battery installation when normal power is interrupted, and return to standard service when utility feeders are again operative. This is accomplished through the operation of a single-coil momentarily-energized mechanism integrally interlocked both mechanically and electrically. Operating current for the transfer switch is provided by the source *to which* the emergency lighting load is to be transferred. The emergency battery is a nickel-cadmium 96-cell unit having a rated life of 280-amp-hours. Containers are of welded steel while the charger is a selenium oxide unit having an adjustable charging rate between 0.2 and 3.0 amps.

In addition, outside receptacles make it possible to plug-in portable generators which would supply power and lighting requirements in the event of a failure of long duration.

BATTERIES OF FLOODLIGHTS, pole-mounted 50 feet above aprons, provide ample illumination for safe night-time loading and servicing of planes. Poles are capped with obstruction lights and are equipped with liberally-sized crows-nests for inspection and re-amping purposes.



APPROACH LIGHTING for new instrument runway, installed previously, consists of 14-foot-wide "bars" of incandescent lamps, plus series of billion-candlepower condenser-discharge crypton lights flanked by banks of neon tubes. Crypton lights flash in sequence, "pointing" to centerline of runway.

So that the watch engineer can maintain constant supervision of all critical equipment and lighting, a central control panel is equipped with illuminated switchplates, annunciators and audible alarms. The panel is of formed steel, with access doors permitting entrance to the rear of the walk-in unit to facilitate wiring or inspection. Doors have vault-type handles, holding each closure securely at top, bottom and center, while interior illumination is provided by lamps which are switched on from the *exterior* of the panel. Wires entering the unit are permanently labeled with fibre identification tags and, in the interest of monitoring accuracy and positive operation, the panel is divided into three separate sections—for lighting, motor control, and trouble.

The lighting section has visual annunciators of the illuminated-message type, that is, with white translucent lettering on a black background. Each identification marker is backlighted by two 3-watt lamps so that failure of a single bulb would not completely obliterate the lettering. Therefore, when a switch located in this section is "on", the message is illuminated; but when the switch is "off", the message disappears.

The motor section is similarly equipped and, in addition, incorporates a series of remote-control start-stop or fast-slow mushroom-head pushbuttons.

Illuminated message-markers on the trouble section are backlighted by four lamps (2 red, 2 white) so that, if an important actuating device were not working properly, the message would flash in alternating colors, while the attention of the engineer would also be attracted by an audible signal. The alarm can be shut off promptly by manual control and, as soon as the trouble has been located and corrected, the red lights are taken out of the circuit, leaving a steady white message visible instead of a flashing two-color warning.

Arrangement of Panels

Throughout the building, main distribution panels are suitable either for 3- or 4-wire 208-volt 3-phase service. Neutrals are of solid bar construction, while panel cabinets are code-gauge galvanized sheet steel having lapped and welded joints, and continuous flanges for flush mounting.

Local power and lighting panelboards are suitable either for 120- or 208-volt 3-phase 4-wire service, with main lugs for incoming power and fully-magnetic non-thermal quick-make-break branch circuit switches.

All panels are arranged so that single-pole branch breakers are connected in pairs, that is, breakers 1 and 2 are connected to Phase A; breakers 3 and 4 are connected to Phase B, and breakers 5 and 6 are connected to Phase C. Additional breakers on the panel repeat this sequence. Therefore, where a 2-pole breaker is required, it can replace any two single-pole circuit breakers adjacently located on either side of the panel. Similarly, where a 3-pole breaker is required, it may be substituted for any three consecutively-arranged single-pole breakers.

As to wiring, it is run mainly in conduit or underfloor ducts, with all exposed conduit supported by galvanized pipe straps, clamps or hangers secured by gun-type welded bolt studs when the supporting surface is metal, secured by expansion bolts when the supporting surface is concrete or masonry, and secured by lag screws when the backing is wood.

Underground conduit is sheathed in a 3-inch concrete envelope, with conduit joints staggered and with conduits securely supported and spaced. Where future extensions are contemplated, conduit is stubbed out 6 inches from the end of the concrete sheath, capped and painted with bitumastic paint. All underground conduit is connected directly to the main grounding system.

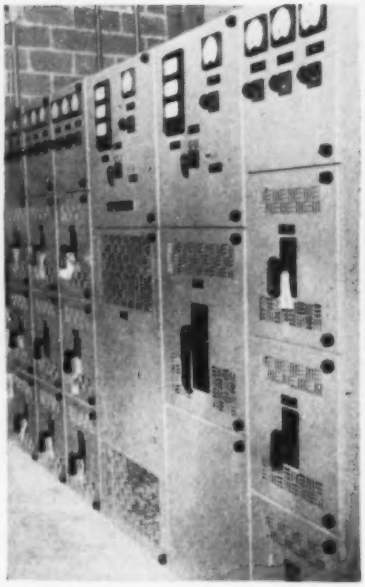
Wherever conduit lines cross structural expansion joints, standard conduit expansion fitting are installed, and where flexible connections are required in wet locations, they are obtained through watertight flexible conduit sections.

In addition to underground conduit, the grounding system is connected to all-metal raceways, electrical devices and enclosures, lighting fixtures, motor frames, and metallic shields for primary power cables. In this grounding system, lugs and connections are solderless, buried connections are covered with Scotch electrical tape, and connections between grounding cable and grounding rods are made by the Cadweld process. Maximum resistance to ground at all locations is less than 10 ohms.

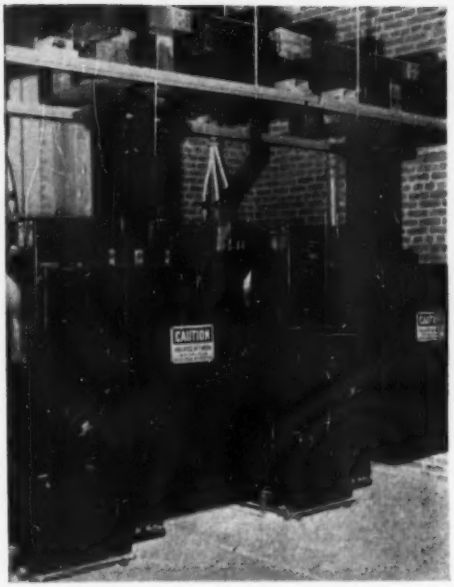
Dramatic Lighting Installation

During the day, the concourse is flooded with natural light from the all-glass observation wall. At night, however, the dark-blue acoustically-treated, suspended metal ceiling is illuminated

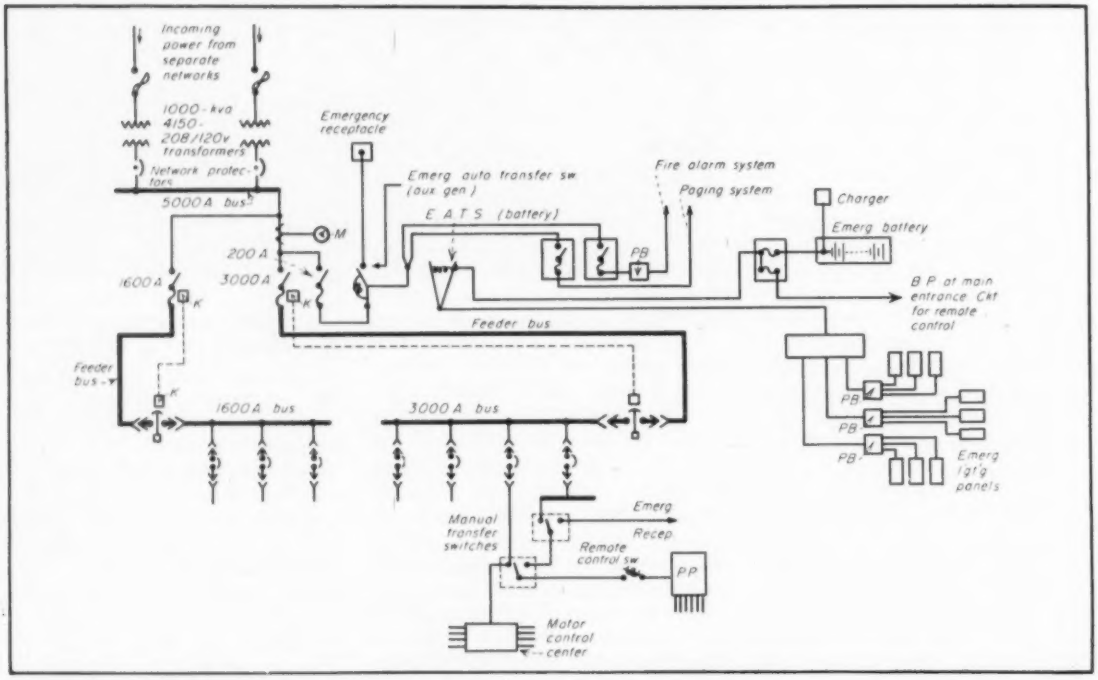
ELECTRIC WINCH, used for pulling feeders into conduits, was one of many modern portable power devices used during the construction period at Newark Airport. Other useful power tools included drills, benders, cutters, threaders, stud guns and welding equipment.



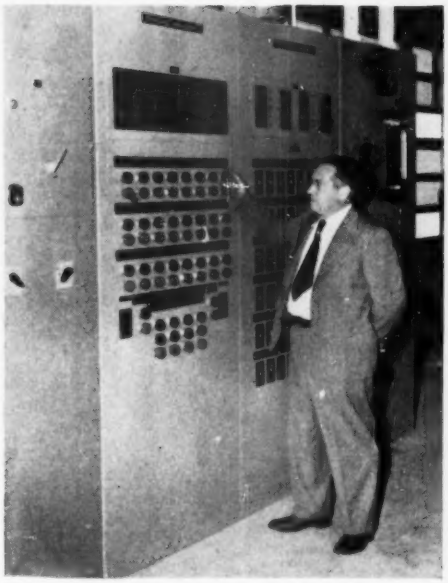
BREAKER CUBICLES in main substation have removable air-breaker elements equipped with interlocking devices that trip when compartment doors are opened. Buses and all outgoing cable connections are located in full-height rear compartments.



TRANSFORMERS are 1000-kva 3-phase 4-wire liquid-cooled units surmounted by 5000-amp square copper bus structure that carries secondary power through wall sleeves to adjacently-located distribution substation. Copper bus is equipped with flexible joints.



INCOMING SERVICE enters transformer vault through underground ducts, passing through oil switch cutouts to two 1000-kva liquid-filled transformers. Secondary power is carried through masonry partition to service entrance switches in main substation switchgear room via 5000-amp square copper feeder bus, while overhead feeder buses link these key-interlocked switches with secondary manually-operated breaker cubicles. Also indicated here are the emergency receptacles for mobile generators, batteries with automatic transfer switch, grounding system and various panel locations for power and telephone service, fire alarm and paging system.



CONTROL PANEL permits watch engineer to constantly supervise and remotely control lighting and all critical motorized equipment in the building. Backlighted translucent-letter switchplates, annunciators, audible alarms and walk-in cubicles facilitate rapid inspection.

QUALITY CRAFTSMANSHIP is evidenced by neat appearance of control cables grouped, color coded, labeled and tied together in this terminal cabinet. Cables terminate on upper floor at watch engineer's monitor and control center, where remote supervision is possible.

by hundreds of recessed down-lights simulating a star-studded sky. In other sections of the building, lighting is variously functional, decorative or dramatic, with more than 70 different types of fixtures employed for this objective. Spectacular, colorful, strategically-placed advertisements are brilliantly illuminated and attractively framed, while numerous dioramas depicting historic aviation events are also uniquely lighted.

Depending upon location, function and intensity of illumination required, fluorescent fixtures are variously lamped with 1, 2 or 4 tubes, are either recessed, surface mounted or suspended, and are variously shielded by louvers, Alba-lite glass panels or Fresnel lenses supported in cradles. Lamps are generally warm white with 90-degree turn-lock holders and high power-factor ballasts. Slimline lamps are single pin instant start.

In addition to lighting main areas, fluorescent lamps are also used as backlighting for translucent-panel directory signs having opaque lettering, as edge-lighting mediums for double face notices at loading gates and luminous panels beside stairways, as direct-radiation wall-mounted germicidal units in the form of ultra-violet tubes in areas where food is prepared for serving, and, when shielded by U-V glass panels, they provide a black-light source to illuminate interesting fluorescent wall displays in the cocktail lounge.

U-V Light for Displays

Many of the display signs in the main concourse combine black light with incandescent, with a main contactor controlling the entire group of units, a timer and flasher mechanism for the incandescent lamps, and an astronomical clock and switch for the black lights. In this manner, the black light is in continuous use during preselected hours while the white light flashes on and off at fixed intervals. Since these displays combine fluorescent paints with standard oil-base pigments, the signs become animated, changing colors, effects or messages at each white-light cycle.

For cove lighting installations, such as that found in the restaurant, cocktail lounge and coffee shop, cold cathode lamps are used in series, with each separate circuit consisting of a transformer, a protective relay and the required number of lamps. Cold cathode lamps operate at 120-milliamps, have a diameter of 25-millimeters and are warm white in color. Many of these installations are, in addition, equipped with manually-operated autotransformer gang-operated dimmers.

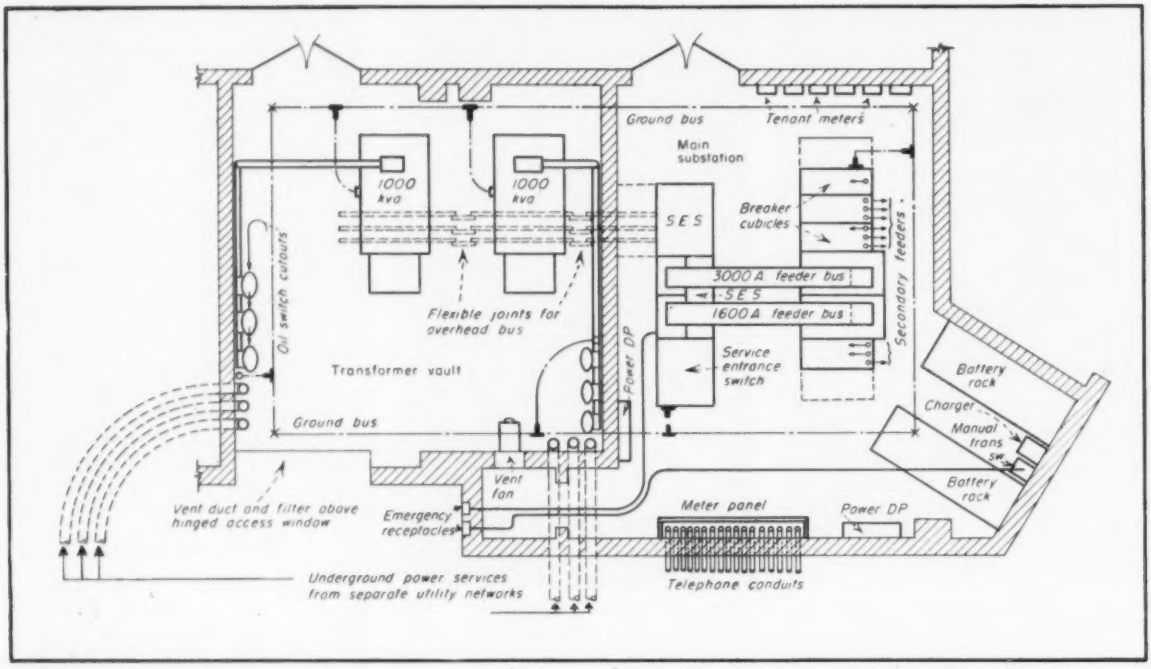
Diversity also characterizes the incandescent lighting of the airport terminal. Top-access high-ceiling downlights are variously lamped with 500-, 400- or 300-watt bulbs, and combine either standard reflectors for general illumination or optical systems for accent purposes. Where ceiling heights are lower, downlights are lamped with 150-, 100-, 60- or 40-watt bulbs, with Fresnel lenses or annular louvers installed to obtain shielding, diffusion or direction. For local displays there are pendant-suspended bullet-hood units containing R-38 or R-40 floodlamps, as well as semi-recessed focusing eyeball spots.

Exterior Illumination

On the exterior of the terminal building, 500- and 200-watt floodlights consist of half-circle hooded weatherproof assemblies with silvered glass reflectors, while illumination over driveways, parking space and loading aprons is provided by street-light units mounted at a height of 25 feet on ornamental tapered elliptical arm-type poles having TB-2 transformer bases, plus series of weatherproof R-lamp assemblies on 50-foot poles. This exterior lighting is controlled from remote positions by contactors activated either by time switches having astronomical dials, by manual switches in the watch engineer's control room, or locally, by key switches.

In addition to these power and lighting facilities, the terminal possesses an intricate telephone and public address system which includes 300 telephones, 41 public booths, special circuits for weather, radio, teletype and CAA traffic control, a dial intercommunication system, a telautograph system, an IBM self-correcting clock system, and over 800 pairs of low-potential wires extending throughout the building. More than 200 speakers carry announcements, paging calls and background music, giving clearly-audible blanket coverage at an unusually low-decibel level. Speakers along the observation desk announce flights, describe plane characteristics and movements, disseminate interesting facts related to the history of aviation and to the development of the field during its quarter-century existence.

From either end of the building, glass-enclosed arcades extend outward



SERVICE ENTRANCES deliver primary power from two separate utility company networks and provisions exist for bringing in a third feeder if necessary. A second source of power (a 96-cell battery installation) is also provided for essential lighting and electric equipment in the event of a complete ac power failure, with an automatic switch making the transfer. Should the failure be so serious that a lengthy ac interruption is anticipated, mobile truck-mounted diesel or gasoline generators can be connected to the system through exterior emergency receptacles.

to 22 loading gates, while a paved, landscaped and floodlighted parking space for 650 cars lies immediately in front of the main entrance.

In general, wires and cables are single conductors for all locations, with solid conductors in use for 8-gauge and smaller and stranded conductors for 6AWG and larger. Smallest wire size for power or lighting use is No. 12. Cable used is generally RH (used for fire alarm wiring and 120/208-volt distribution), rubber-insulated 5000-volt (for 2400/4160-volt primary circuit phase wiring), and weather-resistant single-braid wire (for grounding purposes).

All 5000-volt cables are covered with a layer of semi-conducting tape, standard ASTM insulation, a double lap of compound-filled fabric, a layer of impregnated paper, a tinned copper shielding tape, plus an exterior cable sheath conforming to specifications for polychloroprene sheet compound. Bending radius is 12 times cable diameter.

Throughout the entire installation, inspection clearly indicates that the new facilities at Newark Airport provide tops in service to pilots, air travellers, ground personnel and visitors alike. And all of these services and facilities have been combined with smart, modern design, excellent craftsmanship in all work phases, and scores of other conveniences.

Designed by The Port of New York Authority, this modern building was erected by the Turner Construction Company and wired by the Lightning Electric Service Company of Newark.

Previously installed landing aids at Newark Airport include centerline approach lights extending outward 3000 feet from the end of the 7000-foot instrument runway, an instrument landing system (ILS), precision approach radar (PAR), high intensity runway lights every 100 feet (usual distance is 200 feet), threshold markers at each end of the runway, standard taxiway lights, a 3-foot-wide dashed white stripe extending the full length of the runway, and solid white stripes outlining the shoulder lines. In accordance with CAA standards, runway lights are white and yellow, and taxiway lights are blue.

The centerline approach lighting system consists of thirty 14-foot-wide horizontal bars spaced 100 feet apart, each bar consisting of ten 200-watt R-40s. In addition, high-intensity billion-candlepower condenser-discharge crypton lights and series of neon tubes are mounted below these bars, arranged to flash in sequence so that, when viewed in perspective by the pilot of an approaching plane, a broad stripe of light is seen leading to the beginning of the runway. Also, moving streaks of illumination, similar in appearance to the paths of tracer bullets, point directly to the runway's centerline.

These many features collectively add up to one of the finest airports in existence.

The electrical installation in Newark Airport's new terminal building represents the combined efforts of the following:

For The Port of New York Authority—John Kyle, Chief Engineer; James Meyer, Assistant CE; Carl Johnson, Design Engineer; C. E. Sandford, Asst. Design Engineer; Joseph Brain, Chief Electrical Inspector; Frank Carey, Resident Engineer; Fred Fontenello, Assistant RE; Guy Tozzoli, Project Engineer and Carl Papaleo, Electrical Supervisor.

For the Lightning Electric Service Company—Jules Friedland, V.P. and Coordinator; Charles Hannen, Superintendent; Wynn Rose, Asst. Superintendent and Edward Schroeder, General Foreman.

FIG. 1. View of Stonestown Shopping Center in San Francisco, which is typical of the large one-stop shopping centers being constructed in all sections of the United States.

Electrical Planning

For Shopping Centers

By **F. R. Roubik** *General Electric Company*

Suburban shopping centers are offering a new major market for electrical construction. The rapid increase in suburban population (twice that of population increases in cities) has forced store owners and real estate firms to follow customers to the suburbs. Retailers throughout the country are planning and erecting large shopping centers, which combine the latest architectural developments with modern electrical systems and practices into attractive, functional building designs.

REGIONAL one-stop shopping centers offer store owners a highly desirable and acceptable method of selling to large numbers of suburban retail customers. In the United States these shopping centers perform a commercial function and at the same time, by leasing their theaters and exhibit halls to local groups and clubs, they serve as the social, cultural, and civic crystallization point for our vast, expanding suburban population.

Alert store owners now realize that a completely new, well-organized sales approach, utilizing all the beneficial qualities of shopping centers, must be used in order to assure sufficient sales and profit. Electrical contractors and electrical equipment

manufacturers also are using beneficial architectural and mechanical qualities together with the latest developments in the electrical field to provide shopping-center owners with the following benefits:

1. Safe electrical equipment, having all current-carrying components completely enclosed.

2. Flexible electrical systems which permit rapid load growth or regrouping of load areas.

3. Electrical equipment which can be easily installed and easily maintained.

4. Electrical distribution systems and equipments that are economical to operate, and have a low initial cost without sacrificing needed reliability.

5. Electrical equipment and systems that can be easily incorporated into the architectural plans of modern integrated shopping centers.

Shopping centers usually consist of one or more large multi-storied department stores, grouped together with 40 to 60 smaller stores, restaurants, banks, medical facilities, auditoriums, and amusement buildings. The large shopping center is completely air-conditioned and contains 500,000 sq. ft. of merchandising store area, surrounded by well-lighted parking facilities for 4,000 automobiles. Fig. 1 shows a typical shopping center.

The average electrical load for a shopping center of this size is approximately 4,000 kva. The electrical load for a typical shopping center usually consists of store area and display lighting, parking facility lighting, traffic control equipment, air-conditioning compressor and pump motors, escalator motors, and associated fan and blower motors.

Radial System of Power Distribution

The electrical load for a shopping center is not concentrated in one area. In fact, the central boiler house containing centralized air-conditioning and heating equipment (as advocated by Victor Gruen and Lawrence P. Smith, leading architectural authorities in the field) may be remotely located from much of the major lighting load.

The lighting load is concentrated in each of the many separate buildings of the shopping center, but both the boiler-house electrical motor load and the remotely-located lighting load can be readily and economically serviced by a radial distribution system employing load center unit substations. A circuit arrangement for the radial system is shown in Fig. 2.

Radial systems have a lower initial cost over other available systems because cable requirements for this type of system are at a minimum and only one medium-voltage primary feeder cable is required to feed several load centers at various locations throughout the shopping center. Radial systems can be expanded by merely extending the medium voltage feeder cable to a new load-center unit substation located where the additional power is required. For larger shopping centers, the secondary-selection might be used to provide greater ease in system operation.

Unit Substations

By using unit substations, the actual transformation from a distribution to a utilization voltage occurs in the transformer of the unit substation, which can be strategically placed in the heart of the electrical load area. By placing the unit substation as near as possible to the area needing power a reduction in cost will be realized, as the heavy low-voltage cable required to reach the load areas will be reduced to a minimum. One such substation with a transformer secondary rated 480Y/277 volts can feed both motor and high-voltage fluorescent lighting loads in the area, thereby effecting double economy by using only one piece of equipment for both functions, and by saving valuable floor space.

Unit substations can be furnished with primary disconnecting air-break switches, or air-circuit breakers, and the transformers can be either of the dry-type construction or the non-inflammable liquid-filled variety. The secondary air circuit breakers of the unit substation can be either the magnetically operated type for higher rating, or plastic case molded breakers for lower current carrying and interrupting capacity rating. Regardless of the individual design of the unit substation, installation time is reduced to the one operation of connecting the incoming primary cable and the outgoing secondary cable and conduit.

Emergency lighting systems which are vitally important in shopping centers can be fed from either the primary or secondary side of the unit substation transformer by means of an interrupting switch with current limiting fuses. Unit substation equipment can also be incorporated with motor control equipment, and the two types

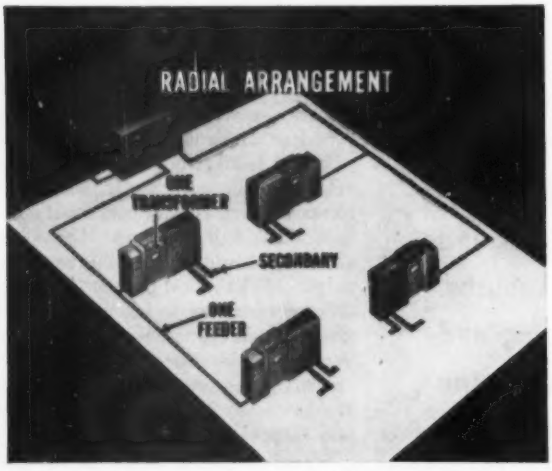


FIG. 2. Circuit arrangement for radial system of power distribution employing load-center unit substations whereby one medium-voltage primary feeder cable feeds several load centers at various locations throughout the shopping center.

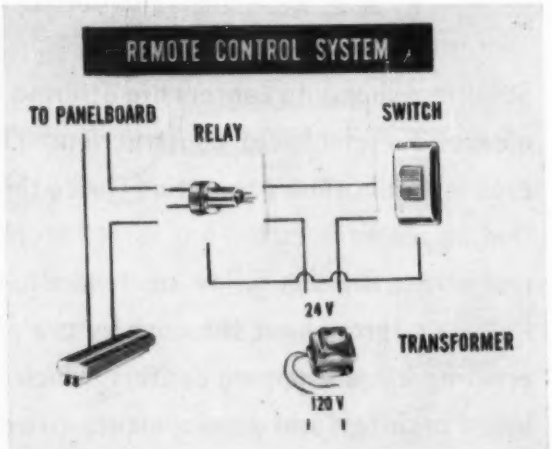


FIG. 3. Remote control wiring system employing the 24-volt switches and control relays for the fluorescent lighting which will enable all lighting switches for a particular area to be located in one centralized station.

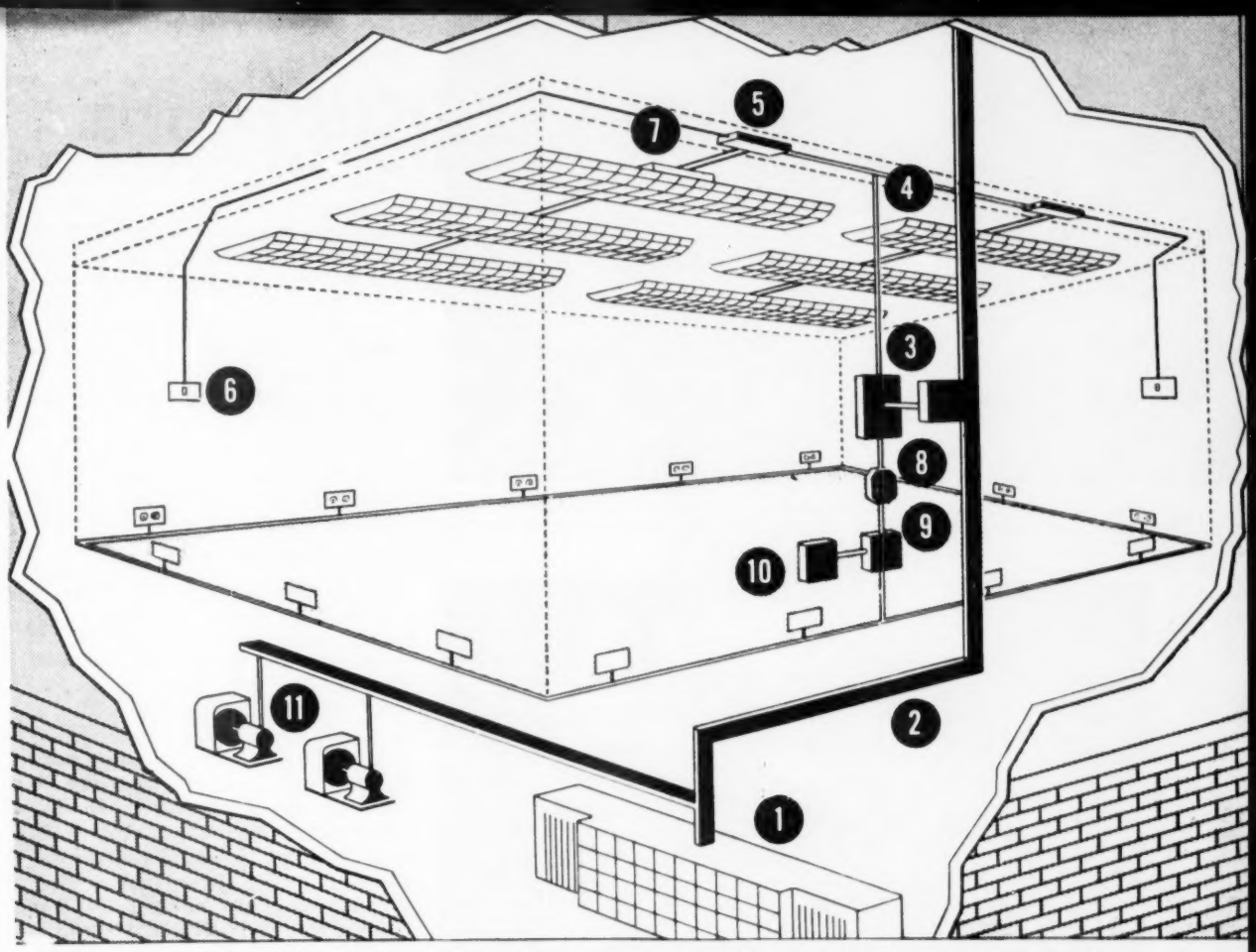


FIG. 4. Here's how the system fits a typical building—Power is received by 480Y/277-volt secondary equipment **(1)**. Busway risers (or conduit and cable) **(2)** Carry the three phase power to panelboards **(3)** on each floor. From these panelboards, 277-volt line-to-neutral lighting circuits **(4)** are run to remote-control relays **(5)** in the pull boxes. G-E remote control switches **(6)** in isolated 24-volt circuits operate these relays which control power to the lamp ballasts **(7)**. A 480-120-volt transformer **(8)** supplies power to the panelboard **(9)** from which floor circuits are run to accommodate business machines, etc. A small transformer in one floor circuit **(10)** supplies 24-volt power to the control circuits. The same distribution system supplies 480-volt line-to-neutral power to pump, air-conditioning, and elevator motors **(11)**.

of equipment can be installed in a common attractive alignment in areas where both lighting and motor control is required.

This type of equipment is suited for installation in the centralized boiler house and air-conditioning machinery room where the control of motors driving the essential compressors, pumps, and recirculating equipment can be controlled from one location. This type of equipment arrangement not only reduces the burden of the operating personnel, but also reduces the floor space needed as compared with individual motor controlling devices located at random.

By using unit substation equipment in aligment with lighting and motor control equipment, the benefit of having all maintenance work done in one location will be realized. Additional traffic and inconvenience in the merchandising areas caused by maintenance personnel will also be reduced.

Sewage facilities for shopping center projects usually do not have a sufficient capacity to absorb the total air conditioning condenser water discharge, and evaporative condensers or cooling towers must be used. When recirculation of cooling water is required, motor control centers, incorporating motor starters with circuit disconnect means in one completely-enclosed coordinated equipment, can be located in the critical areas for the control of all motors.

Unit substations and centralized motor control centers can be easily modified for future expansion. By installing additional vertical cubicles which align with the existing equipment, the store owners are assured that their electrical system and equipment can grow as their shopping center facilities expand.

Higher Voltage Lighting

The economies of using higher voltage power supplies for fluorescent lighting are no longer limited to industrial applications. The National Electrical Code now extends the use of 480Y/277 volts distribution to include supplying ballasts of fluorescent fixtures for office buildings and stores. Fig. 4 shows how the new higher-voltage power system is installed in a typical building. Higher voltage lighting has been made possible by the development of a small control relay operating on 24 volts which can be mounted in the lighting fixtures or in panelboards. This low noise level relay is energized only when opening or closing the lighting circuits. The wall switches controlling these relays operate at 24 volts, thus assuring complete safety to store personnel and customers and allowing the store owner to realize the benefits of higher-voltage lighting. The use of this higher 277-volt supply for lighting fixtures saves copper in installation, and reduces the space required for lighting circuits.

FIG. 5. View of well-designed lighting system in parking area of modern shopping center, using luminaires mounted on attractive modern street-lighting standards.

FIG. 6. A four-unit capacitor rack in a Mid-Western department store improved the store's power factor by 20% and reduced total power billing costs 18 to 20%.

The development of higher-voltage lighting was inspired by modern buildings using the same principles of shopping centers, that is, large electrical loads using fluorescent lighting and major motor loads for air-conditioning equipment. By using a secondary voltage of 480Y/277 volts, motors used by air conditioning equipment can be operated from the line-to-line voltage of 480 volts. By extending the neutral wire to the lighting feeders, the lighting load can be equally distributed between all three phases and neutral on the available 277 volts.

By using this modern and reliable power system for large commercial buildings such as regional shopping centers, and considering local building codes and various construction features, a saving of approximately $30 per kva can be realized together with a saving of four pounds of copper per kva, with the use of the 480Y/277 volt distribution system. Using a secondary voltage of 480Y/277 will enable the shopping center owner to realize an approximate saving of 40% over similar systems employing separate 480-volt substations for motor load and 120-volt substations for lighting loads. This saving can be passed on to the renting tenants of the shopping center as another inducement for shopping center occupancy. For the smaller shopping centers and commercial buildings, it may be more economical to serve the load directly from an existing 208Y/120 volt system.

The use of a remote control wiring system (shown in Fig. 3) employing the 24-volt switches and control relays for lighting operating from either a 480Y/277 or 208Y/120 volt system will enable all lighting switches for one particular area to be located in one centralized station. Watchmen and cleaners can then turn on the necessary lighting upon entering the store area and, after they have completed their work, they can turn out all lights by a duplicate master control switch located on the opposite end of the store. Since the wire which is required for this 24-volt remote control system is considerably smaller than the conventional 208Y/120 control wire, a considerable saving in installed cost of this high-voltage lighting system can be realized. Time switches can be easily incorporated into this remote control system for the operation of display window lighting and the lighting of walkway areas.

Primary Power Supply

The advantages in using a 480Y/277 distribution system for shopping centers is not restricted exclusively to shopping centers which have an available medium voltage source from 2400 to 13,800 volts. Although a common method would be for a power supply in the medium voltage range to be furnished to the shopping center by the power company and fed through switchgear equipment located in the boiler house to the individual load centers located throughout the shopping center, the saving realized by using the 480Y/277 volt system can also be adapted to other available primary voltages.

In power companies network areas having a 208Y/120 volt supply to the shopping center, autotransformers which are relatively inexpensive ($5 to $8 per kva installed) can be used to boost the primary voltage for distribution to the various lighting and motor load areas at a voltage of 480Y/277 volts. Although this arrangement cannot be readily adapted to the load-center unit substation principle of power distribution, it will nevertheless offer a saving of $22 to $25 per kva by using the 480Y/277 volt system.

Capacitors Improve Power Factor

Many times in shopping centers the advantages obtained from using capacitors to improve power factor are completely overlooked. The induction motors that usually drive the air conditioning pump and compressor equipment require magnetizing current from the electrical supply cables which do no effective work. Although this magnetizing current does not perform useful work, it must be taken into consideration when determining the proper size cable for feeding the various motor load areas and the voltage

(Continued on page 183)

MODERNIZING Office Wiring

By Robert Moser
President
Moser Electric Company
Fort Worth, Texas

A MODERN electrical system is today the heart of a completely remodeled office area in the First National Bank, Fort Worth, Texas. Here, a new electrical layout was installed to replace an antiquated arrangement of overloaded feeders and skimpy branch circuit wiring. The following is a breakdown of job details.

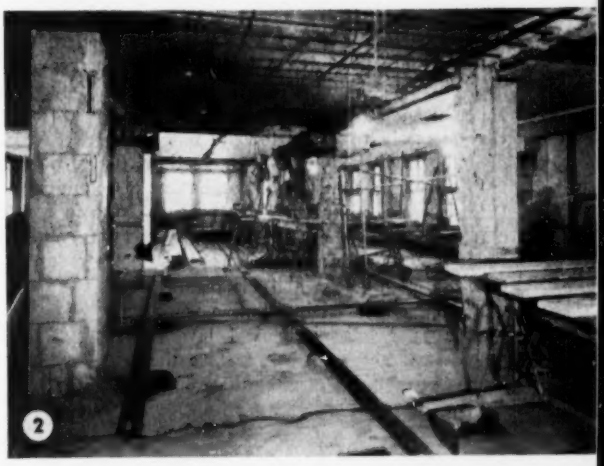
STEP 1: During the initial stages of overall modernization, old wiring and most of the old conduit was removed from the interior. Previously, branch circuits originated at two old 3-phase, 4-wire fuse panelboards (one shown on column at ARROW). One fuse panel was fed by 4 No. 8's; the other by 4 No. 1/0's. These feeders and panels were removed. New conduit was run and wire was pulled. Each of the old fuse panels was replaced with a circuit-breaker panelboard, and four No. 2/0 feeders were pulled to each of the new 120/208-volt panelboards. Telephone cabinets were also installed.

STEP 2: As shown, the old wood floor of this office interior had been laid over a base which was partly finished-concrete-slab and partly cinder-fill. Modernization called for level slab throughout the area. And inasmuch as many business machines and desks were to be used in this interior, a floor duct wiring system to provide extensive and flexible circuitry for convenience receptacles and telephones was required. To meet the problem of installing a floor duct wiring system in an area which already had a good bit of finished concrete floor slab, flush-duct was chosen. According to our layout of the duct system, channels were routed out of the finished slab area and the duct was laid in these channels with its top surface flush with the surface of the slab. (ARROW) The cinder-fill was removed from the other areas and the rest of the duct system was laid conventionally on concrete saddles, again with the top surface of duct flush with the level of finished slab. By design, junctions in the duct system were made only in areas where cinder-fill had existed, thereby avoiding having to rout out a considerable amount of slab. Boxes for receptacles, lighting outlets and music system loudspeakers were also installed.

STEP 3: When the flush-duct system and conduit feeds and tie-ins were installed, concrete was poured in the old cinder-fill areas and finished to the level of the already existing slab. Wires were pulled in the flush-duct system, and lighting circuits in conduit were completed to the CB panelboards. To complete the flexible system of electrical arteries in the interior, plug-mold was installed along work areas and around column benches to provide for a heavy concentration of business machines in any location.

STEP 4: Topping-off the electrical work was done after the installation of the floor tiles and acoustical ceiling. Loudspeakers for the office music system were mounted on regular intervals in the ceiling as shown. Floor receptacles from the flush-duct can be seen in the rear (ARROW). To provide modern lighting intensity and quality, 80 four-lamp, 48-inch slimline, fixtures were installed, spaced to avoid air conditioning ducts. Fixtures are surface mounted, with luminous side panels and an upward light component, and provide 70 footcandles on the working level. Although not shown in this photo, louvers are used for shielding on the fixtures.

1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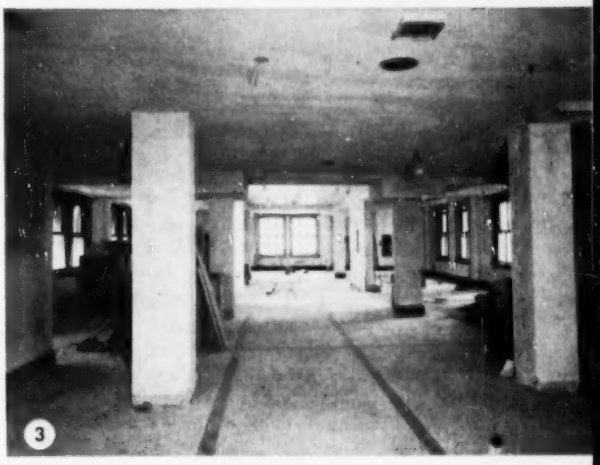
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4

Chicago Contractors Develop

SUGGESTED GRAPHIC WIRING SYMBOLS

. . . to clarify electrical layouts. New symbols appear in the appendix of the 1953 Chicago Electrical Code and are offered for consideration in predicted revision of ASA Standard Z32.9 (Y32.9).

By A. C. McWilliams*

Chairman, Codes and Standards Committee, Electrical Contractors Association of City of Chicago, Inc., Chicago, Ill.

ELECTRICAL layouts in the Chicago area are acquiring a *new look*. They are becoming easier to read and understand. They are providing additional important data and information formerly relegated to plan notes, equipment schedules, specification paragraphs, or contractor imagination. Consequently, contractors can prepare more accurate cost estimates in shorter time; mechanics in the field spend less time on plan study and clarification and more on actual installation work. Before long, all mechanical layouts prepared in the area will feature the same advantages, will tell a more complete technical story.

Basis of this minor revolution in plan execution is the recent development on a local level of suggested standard graphic symbols for each mechanical field. The movement was sparked by The Technical Advisory Committee of the Mechanical Construction Industries of Greater Chicago, following a long-standing dissatisfaction with the variety of symbols appearing on plans. Consulting engineers frequently supplement the limited and outmoded ASA standard symbols with units of their own design. In an attempt to amplify the intent of bid plans, contractors make shop drawings with additional, more expressive symbols. The net result is that the universal language of symbols ceases to exist and mild confusion reigns.

Prime goal of the Chicago activity is to establish a set of truly graphic symbols that will become a *local standard;* symbols that will be used by all engineers and contractors in their respective fields, that will be understood by all mechanics regardless of project or contractor assignment. Research and development is done by individual committees in each field and coordinated through the Technical Advisory Committee, whose members represent the four mechanical trade groups and the consulting engineers. TAC reviews and screens proposed symbols to eliminate conflict and duplication. After final approval, it will present complete sets of symbols of all trades in pamphlet form.

Electrical Symbols Ready

The complete set of Suggested Standard Graphic Electric Wiring Symbols developed by the electrical contractor subcommittee of TAC is now ready for general use in the Chicago area, designed as a guide for engineers, architects and contractors. The symbols have been approved by the Electrical Contractors Association of City of Chicago, Inc., (Chicago and Cook County Chapter, NECA) and now appear in the appendix of the new 1953 Chicago Electrical Code.

Compiling the new group of electrical symbols was not a quick or easy job. A four-man electrical contractor committee, under the chairmanship of Jack W. Collins, executive-director, Electrical Contractors Association, worked tirelessly for more than a year to come up with an answer. Other committee members were: A. C. McWilliams, chairman, Codes and Standards Committee of the Association; E. E. Leasure, Jr., Association president and president of Monroe Electric Company; and W. W. Giesen, president, Electrical Contractors, Inc.

This committee started with the American Standards Association "Graphical Electrical Symbols for Architectural Plans", approved as American standard Z.32.9 (Y32.9) Feb. 6, 1943, and a set of symbols used by the Chicago Electrical Estimators Assn. They combined the best features of both sets, brought them up to date by adding symbols for new wiring methods, equipment, fixtures, made a number of symbols more expressive by adding markings indicating capacity, switch control, circuit connection, etc. (see list on next page). The net result is a list of symbols which provides as much information as practicable without becoming too complex.

NECA Spurs ASA Revision

While the Chicago activity originated as a local move, it has gained national interest and momentum. Requests for copies of the symbols have been received from outside the Chicago area. A set has been submitted to the appropriate American Standards Sectional Committee for consideration in the proposed revision of the Standard Z32.9 (Y32.9) (Graphical Electrical Symbols for Architectural Plans). At the suggestion of the ASA Sectional Committee, the National Electrical Contractors Association has taken the active lead in the correlation of suggestions and recommendations for revision of the present ASA standard.

NECA activity will center around the functioning of a recently organized Industry Task Group for Consideration of Revision of ASA Z32.9 (Y32.9) "Graphical Electrical Symbols for Architectural Plans". Members represent such industry groups as the National Electrical Contractors Association, American Institute of Architects, American Institute of Electrical Engineers, American Standards Association, American Society of Mechanical Engineers, Signaling Section, NEMA, and manufacturers of specialty wiring materials (multi-outlet assemblies, floor duct, cellular steel floors and related wiring accessories, bus duct, trolley duct). Their prime objective will be the up-grading of the existing standards to

(*Continued on page* 182)

* Chairman, Electrical Industry Task Group for Revision of ASA Standard Y32.9 "Graphical Electrical Symbols for Architectural Plans"; chairman, NECA committee on that group.

SUGGESTED STANDARD GRAPHIC ELECTRIC WIRING SYMBOLS

CEILING OUTLETS

- AND BRACKET
- MAZDA RECESSED
- ONE / TWO FLOOR BOXES
- EXIT - STAIRS FIRE ESCAPE
- EM-EMERGENCY, NL-NIGHT LIGHT
- VP VAPOR-TIGHT
- EX EXP-PROOF
- F OR FAN
- C OR CLOCK
- D DROP CORD
- L LAMP SOCKET
- P PULL SWITCH
- J JUNC. BOX
- SPECIAL a,b,c

RECEPTACLES

- S SINGLE
- D DUPLEX
- T TRIPLEX
- VP VAPOR-TIGHT
- EX EXP-PROOF
- R RANGE
- SPECIAL a,b,c

SWITCHES

- 1 SINGLE POLE
- 2 DOUBLE POLE
- 3W THREE-WAY
- 4W FOUR-WAY
- D AUT DOOR
- K KEY-PUSH
- L ROTARY-LOCK
- PL WITH PILOT LT.
- RC REMOTE CONT'L.
- MC MOMENTARY CONT.
- CB CIRCUIT BREAKER
- WT WATER TIGHT
- EX EXP-PROOF
- SPECIAL a,b,c

TYPICAL OUTLET SYMBOL MARKINGS

A-200
b-1

A,B,etc. = Fixture type
a,b,etc. = Sw. control

ADD FOR BRACKETS TO CEILING OUTLETS

as B-60 C-2 EM

60, 200 etc. = Outlet watts
1, 2, etc. = Circ. connected

Mark all outlets to establish fixture type, wattage, switching and circuit connection. Symbols can be abbreviated, omitting duplicate marks; thus, 3W or . To show two or more devices assembled as one unit, such as Despard, etc., combine symbols = SWITCH & RECEPTACLE, = 3 SWITCHES, etc. a,b,c, indicates SPECIAL OUTLET, describe on plans or in specifications.

FLUORESCENT FIXTURES — RECESSED 2'/40 100W A-a-1; SURFACE 3'/40 150W B-b-1; SUSPENDED 4'/40 200W C-b-1

BUS DUCT — 400A-PLAIN | PLUG-IN

UNDER FLOOR DUCTS — TEL, 110V, SIG

METAL OR WIRE MOULDING — L, R, S

- 1 Φ MOTOR, MARK H.P.
- 3 Φ MOTOR
- GENERATOR, 40 KW.-M.G. SET, MOTOR
- MANUAL MOTOR STARTERS
- AUTOMATIC
- WITH F.-SW.
- SEPARATE N.F SW.
- TOGGLE SW. START-STOP
- PUSH SW
- LIMIT SW. AUTOMATIC
- RELAY SW.
- THERMOSTAT START-STOP
- FLOAT SW.
- PUSH BUTTON
- MESS. CALL
- BUZZER
- VIB. BELL
- SGL. STROKE
- FIRE ALARM
- CHIMES
- FA FIRE CALL
- WATCHMAN CALL
- BEDROOM NURSE CALL
- NURSES DESK CALL
- ROOM DOOR SIG. LIGHT
- D DOCTORS FLOOR CALL
- N NURSES ROOM CALL
- DR'S. IN-OUT REGISTER
- 10 ANNUNCIATOR 10-CALL
- LOUD SPEAKER
- PUBLIC ADDRESS
- S SIREN
- RADIO
- T.V. OUTLET
- PUBLIC TELEPHONE
- PRIVATE TELEPHONE
- INTER-COM. TELEPHONE
- TELEPHONE SWITCHB'D.
- AUTO CALL
- TER.-CABT. TEL. OR SIG.
- T TEL. SERVICE CABINET
- LETTER BOX
- SPEAKING TUBE
- DOOR OPENER
- MASTER CLOCK
- 30 TIME SW. 30 A.
- TIME STAMP
- SPACE HEATER
- SERVICE ENTRANCE
- 1500 A. OIL AIR CIRCUIT BREAKER
- WATTHOUR METER
- LIGHTING PANEL
- POWER PANEL
- CABLE SUPPORT
- CABLE RACK BOX

CONDUIT RUNS — CONCEALED; EXPOSED

E EMPTY CONCEALED; T TELEPHONE; C CLOCK

S SIGNAL EXPOSED

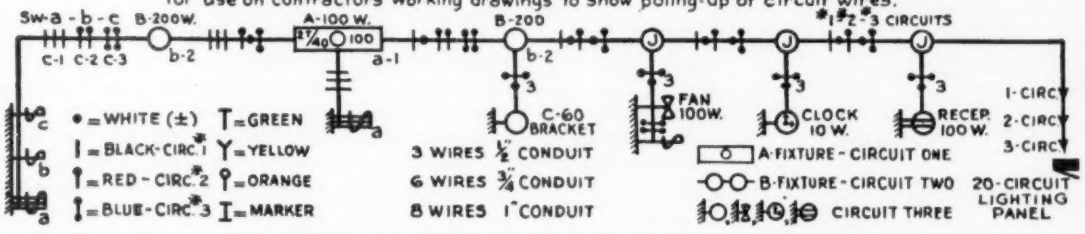
3" 500,000 C.M. — 3W-½

+ ± − 3 WIRE — A B C ± 4 WIRE — CONCEALED CONDUIT FILLS

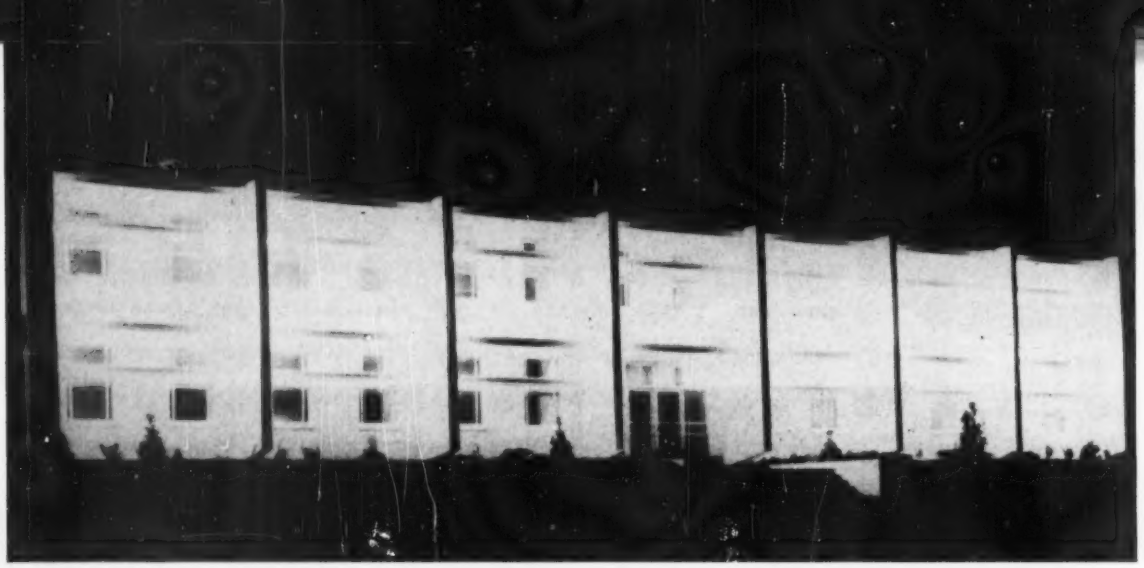
WHITE | BLACK | RED | BLUE — GREEN | YELLOW | ORANGE | MARKER — SYMBOLS, COLOR-CODED WIRE

PHANTOM 3-CIRCUIT, COLOR-CODED LIGHTING DIAGRAM (CONCEALED CONDUIT)

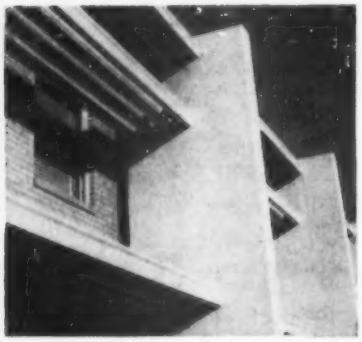
Note: The use of symbols for graphic marking of color-coded circuit wires is recommended for use on contractors working drawings to show poling-up of circuit wires.



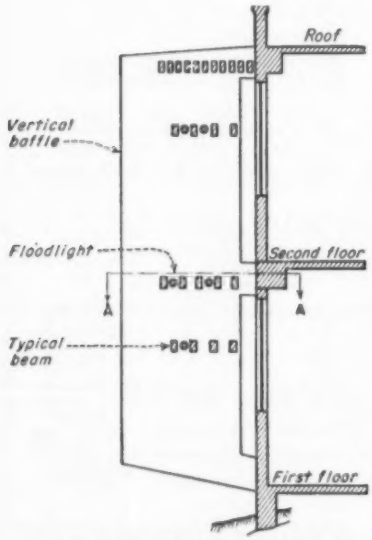
TRANSFORMERS		3 (PHASE) Φ - 60 (CYCLE) ~ - GROUND ⏚				SINGLE LINE UNIT SUBSTATION
1 Φ	3 Φ					
1-PHASE	3-PHASE	DELTA	WYE	4 WIRE	SCOTT	1500 KVA 12000 V — 480 V. — C.B. 2500A — C.B. 800A



NIGHT VIEW of office building of Mississippi State Highway Department reveals depth of contemporary design facade.



BEAMS and **BAFFLES** shield sun rays by day, conceal floodlights by night. Floodlighting makes building appear self-luminous at night.



SECTION ELEVATION AT B-B

FIVE FLOODLIGHTS on one baffle face floodlight vertical surface of baffle on opposite side.

Floodlighting Technique

By Mario G. Zervigon

Electrical Engineer
Louis N. Goodman and Associates
New Orleans, La.

A HAPPY solution to what appeared to be an almost impossible floodlighting problem was developed and applied to the facade of the office and laboratory building of the Mississippi State Highway Department, District Number 2, at Batesville, Miss. This solution, shown in detail in the accompanying illustrations, turned out to be inexpensive, efficient, glarefree, and architecturally sound.

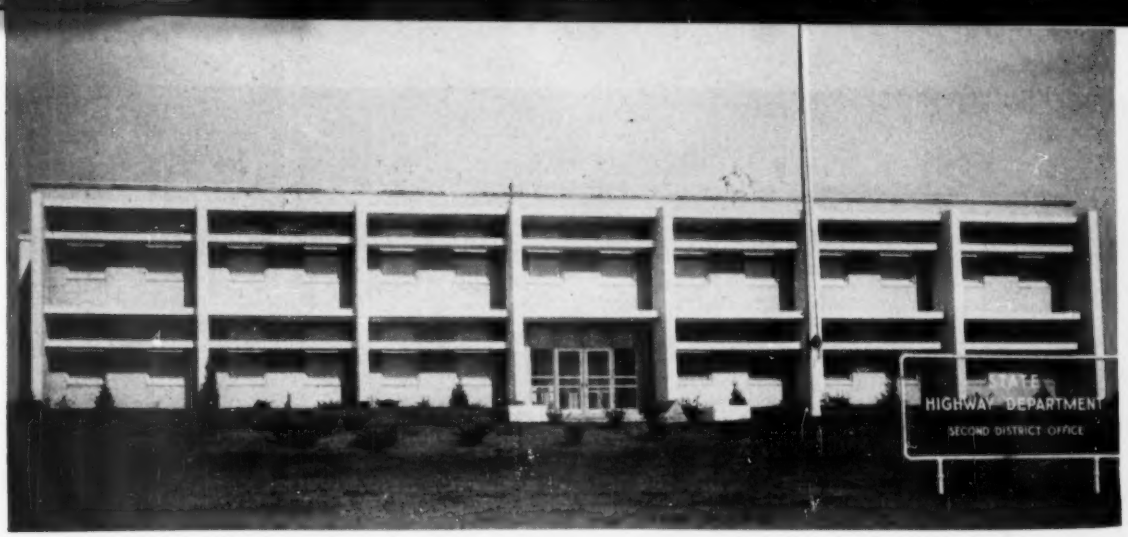
This office and laboratory structure is basically a plain rectangular brick building of traditional design, with a contemporary architectural treatment of the facade. In place of the usual plain surface is a pattern of deep cells, created by a series of vertical baffles tied together by closely spaced horizontal beams. Architecturally, this treatment is most interesting and creates a feeling of bold texture, of depth, where a two-dimensional flatness would otherwise have been. Functionally, the baffles and beams combine to shield the windows from the direct rays of the sun over a large percentage of the day, when the sun is highest. The white baffles add variety to the monotony of buff bricks.

After the architectural design of this building was complete, architects Johnson and Jones of Starkville, Miss., expressed an interest in floodlighting this unusual building facade, provided this could be done within the cost of a very modest budget. Also, it was requested that the three dimensional (3D) daytime effect be maintained in the floodlighting effect at night, if possible.

Faced with these limitations, consulting electrical engineers Louis N. Goodman and Associates, New Orleans, went to work. How could this 3D facade be floodlighted? The conventional method of floodlighting by means of suitable floodlights at some convenient locations in front of the building, with the light beams directed at the building front, was promptly discarded. There were no convenient locations in front of the building where floodlights could be concealed, this method would create uneven shadow patterns, the three-dimensional effect would be minimized or eliminated, and the cost would be excessive.

Since this building faces a highway in a rural area it was decided that low brightnesses would be very effective. Also, if some means could be found to locate light sources on the building or within the cell areas, this would contribute to lighting efficiency. This line of reasoning soon led to the solution, which was finally adopted after careful analysis and test demonstration.

The technique adopted consists of the installation of PAR-38 150-watt



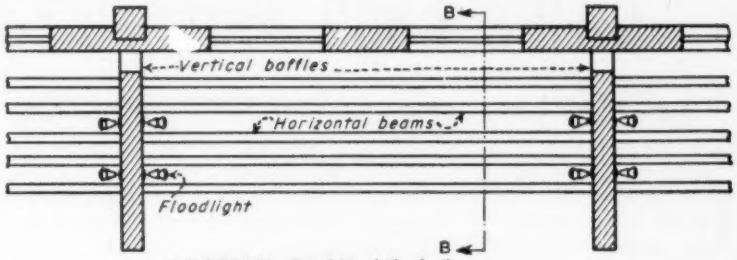
3D CELLS on building facade are formed by vertical baffles and horizontal beam louvers to shield windows from sun.

Maintains 3-D Facade

PAR-38 lamp units concealed in sun baffles on building front floodlight cells in contemporary design and preserve third dimension of depth at night.

lamps in outdoor aluminum holders on the vertical baffles, back to back, and aimed at the opposite baffle in cross-fire fashion. The units are located between the horizontal beams for concealment. Five floodlights are installed on the face of each baffle (see Section Elevation at B-B), two units in the horizontal beams centered in front of second floor windows, two units between beams at second floor level, and one unit between beams centered in front of first floor windows. Each unit projects light to a specific area on the opposite baffle 14 feet away.

No light sources are aimed at the face of the building proper. The buff brick are illuminated by diffused light from the white baffles. This diffused light also washes out shadow patterns from the beams, and reinforces the direct component of spill light from the units. The result is evenly and brightly illuminated baffles, with less brightness on the brick. This contrast and the dark front edges of the beams and baffles preserves the pattern and depth —3D effect—of the facade at night. As a motorist approaches the building along the highway at night, he faces the bright baffles, and the pattern changes as he comes abreast of the building. The rural setting makes the baffle brightness, which is of the order of 10 footlamberts, seem much higher.



FLOODLIGHTS are PAR-38 lamps in aluminum lampholders, installed on vertical baffles and concealed between horizontal beams.

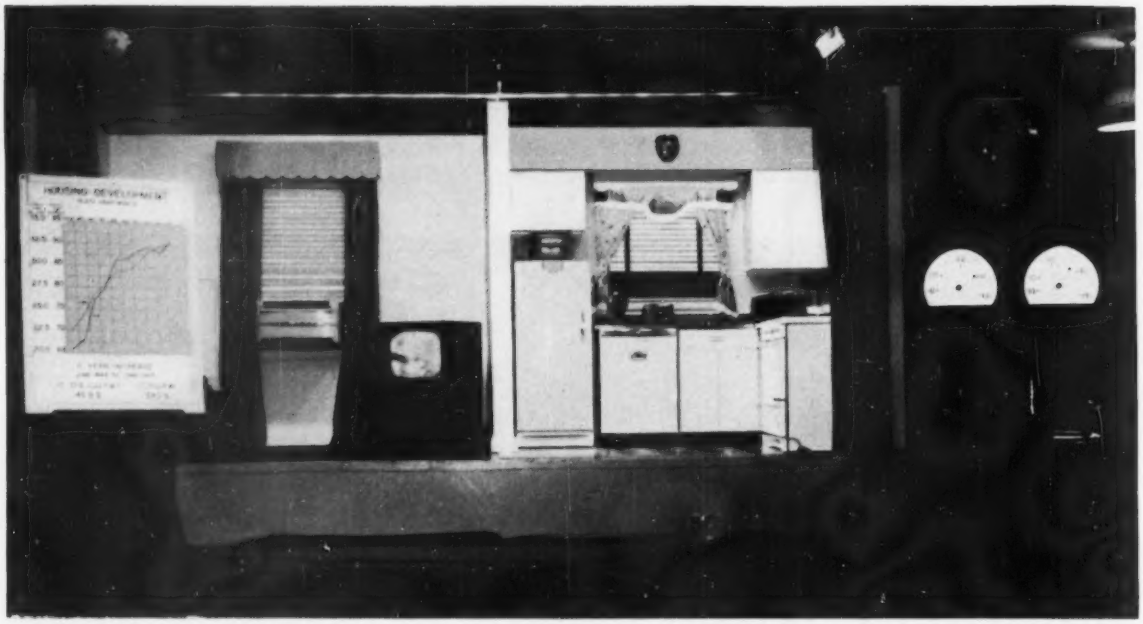
A total of only 68 150-watt lamps in inexpensive lampholders, requiring interior wiring only, were used to solve this floodlighting problem. The 10.2 kw load is served by eight branch circuits. Control is by time switch and magnetic contactor in the feeder to the panelboard.

This installation requires little maintenance. The lamp lens is vertical and remains clean. Beams afford mechanical protection. Relamping is simple, as the baffle-beam structure serves as a scaffold for reaching the lamps. Glare is eliminated, both from inside the building and from the outside, as the lamps are concealed between the beams. Efficiency is high, as the distance from lamps to surfaces lighted is less than 14 feet, and the beam is nearly normal to the surface being lighted. Inter-reflections create a well diffused lighting effect.

Architectural values have been maintained because the structural pattern of the front is still obvious at night. The brightness and color difference between baffles and brick wall enhances the feeling of depth.

The type of light sources used and their flexible arrangement lend themselves to the use of color for holidays or other festive occasions. Color roundels can be applied over the PAR-38 lamps, so that the possibilities for special effects are a challenge to the imagination.

The results of this lighting installation have given a measure of civic pride to the local rural Southern community, and added a pleasant, cheerful note to the night traveler's landscape.



INCREASED USE OF APPLIANCES was dramatized in the Con Ed show with this model apartment. As each device was turned on, the voltage at the apartment—shown at far right—was reduced while service voltage remained constant. When the air conditioner was turned on, the fuse blew.

Cities Face Modernization Crisis

New York kicks off program to bring out rewiring needs in big city buildings

THE critical need for rewiring in large urban buildings is stimulating dramatic industry action. In New York, Consolidated Edison has initiated an intensive campaign to acquaint real estate and construction interests with the urgency of the problem.

Con Ed launched its program at the Waldorf-Astoria on December 1-2 with a presentation in which architects and engineers, real estate, finance and management groups were shown how the tremendous increase in power demand since the war has obsoleted the wiring in most prewar apartment and office buildings. It was emphasized, moreover, that many postwar structures, including some still under construction, have wiring systems that cannot meet the demands of contemporary living. As construction catches up with the demand for commercial and residential space, Con Ed pointed out, it will become extremely difficult to rent property which cannot accommodate a heavy lighting and appliance load.

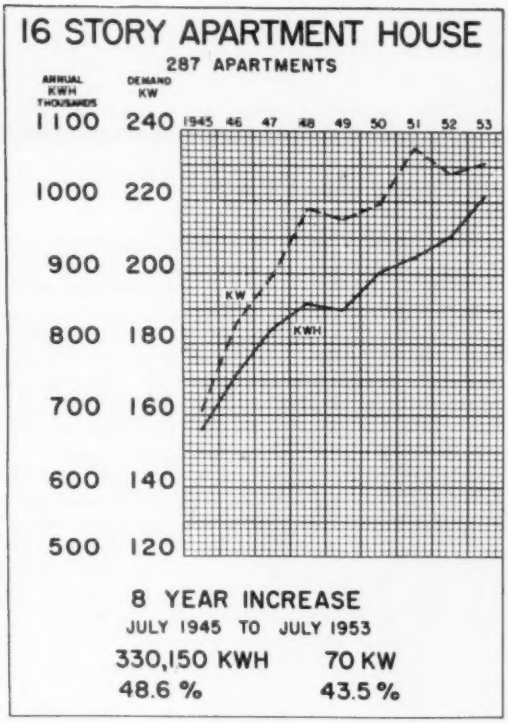
Principal factor in the upsurge of electrical consumption is the amazing increase in the use of appliances. Manufacturers have put millions of dollars into advertising to gain public acceptance; the money has been well spent. Today a typical apartment may have 30 or more of the 56 common household appliances. Many of these —broilers, coffeemakers, irons—are high wattage devices that add substantially to the electrical load.

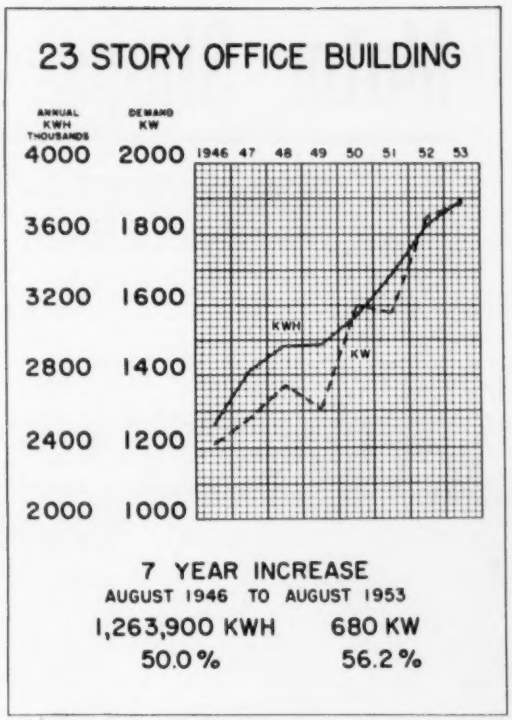
A best seller in the appliance field has been the television receiver. Rated at about 200 watts, it can generally be absorbed by existing wiring systems, though the lower voltage of an overloaded circuit may prevent optimum performance. But the imminent arrival of color television, which will draw from 500 to 750 watts, portends a severe intensification of the need for rewiring.

The problem is not one for future consideration, however. It exists today. The advent of the packaged air conditioner has skyrocketed electrical consumption in apartment buildings. Critical overloads have been created in thousands of apartments by the addition of ½- or ¾-hp window units. Even more multiple dwellings have aroused tenants' dissatisfaction because the necessary 120/240-volt service is not available. Here again the immediate future is threatening. Manufacturers expect that total previous sales of 500,000 units will be tripled in 1954 alone.

The air conditioning problem also faces the owners of commercial properties. Business management has found that increased production in air-conditioned offices more than offsets the initial high investment. The average commercial installation, however, boosts the electrical load by about 5 hp per 1000 sq. ft. Few prewar office buildings are wired to meet this demand.

Like air conditioning, modern lighting has been accepted by industry as a necessary adjunct to efficient business operation. A good fluorescent layout designed to provide 50 foot-candles takes about 3½ watts per sq. ft.





This includes no allowance for the steadily increasing use of electrically operated business machines. Most office buildings are equipped only to meet the 2 watts/sq. ft. minimum required by the National Electrical Code.

The cumulative effect of these factors is startling. In one 23 story building, Consolidated Edison found the demand had gone up 56% in a seven-year period. Annual power consumption had increased over one and a quarter million kw-hrs. A large apartment building showed a rise in demand of 43.5%. These two buildings are not exceptions; they are representative of what is happening *and will continue to happen* in cities throughout the country.

The desire to enjoy the comforts of air conditioning has brought the problem home to the apartment dweller. When he discovers this convenience is not available to him because of inadequate wiring, he becomes dissatisfied with his quarters. He begins to realize that the trouble with his new electric broiler is not poor manufacture, nor is it "weak electricity" from the power company; he discovers that obsolete wiring is the cause of his troubles. His wife hears that this is the reason she can't install an automatic dryer and an automatic ironer—and the dissatisfaction gets worse. As these complaints mount up, landlords will find rentals suffering.

Business men, finding that hard-to-get skilled white collar workers shy away from poorly lit, uncomfortable offices, will be forced to offer an attractive working environment. As suburban transportation is improved, the business operator, like the apartment dweller, is being sorely tempted to seek inexpensive modern quarters outside the city.

This trend toward decentralization presents a challenge. If the city cannot supply commercial and living space suited to modern needs, the future is ominous.

Electrical modernization is an essential aspect of the work to be done. It is the responsibility of the electrical industry to expedite an effective program toward this end. Real estate and building interests must be made aware of the importance of adequate wiring in big buildings. But the job is not one of education alone; it demands active participation.

As an example of what can be done, Consolidated Edison has established its own Adequate Wiring Bureau. The free engineering service offered by this agency includes surveying interior electrical systems in existing buildings and analysis of electrical plans for proposed structures. It then offers suggestions as to how the system can be improved. During its three month existence, the bureau has had an important part in the design or modernization of forty-eight large electrical systems.

The role of the contractor in meeting this crisis is an important one *and a profitable one.* The potential market for electrical modernization far exceeds that of construction work. But it is a market that must be developed. Even though the need for rewiring is becoming so critical that owner cannot long ignore it—even though other agencies of the electrical industry are actively publicizing the situation—it is the contractor, and only the contractor, who can go out and sell the job. Unless this is done, it may be years before the market potential of electrical modernization is realized.

Important as selling is, however, there is another aspect to consider. Since the war, modernization of city buildings has accounted for only a small part of the electrical contractor's work. Consequently, there has been a lag in the development of new techniques in this field.

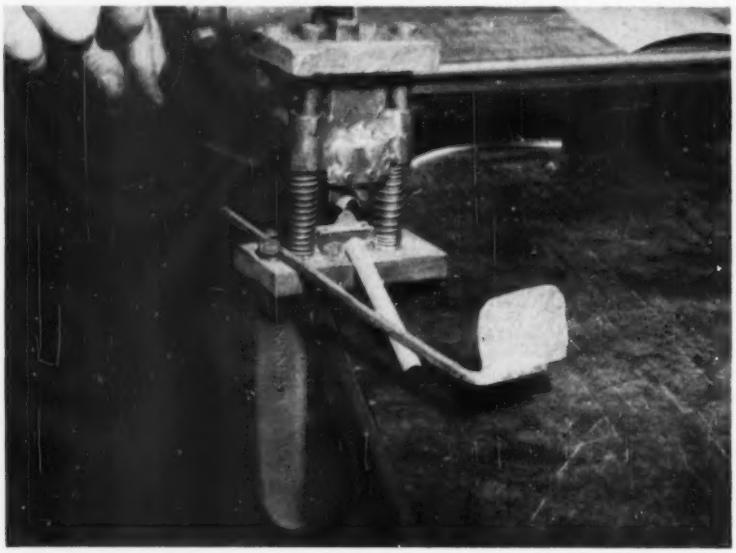
The foresighted contractor who can develop a stockpile of economical modernization techniques and can establish an effective selling campaign through advertising and direct contact work will be rewarded with increased sales, enlarged profits and a head start in a big new market.

Motor Shops

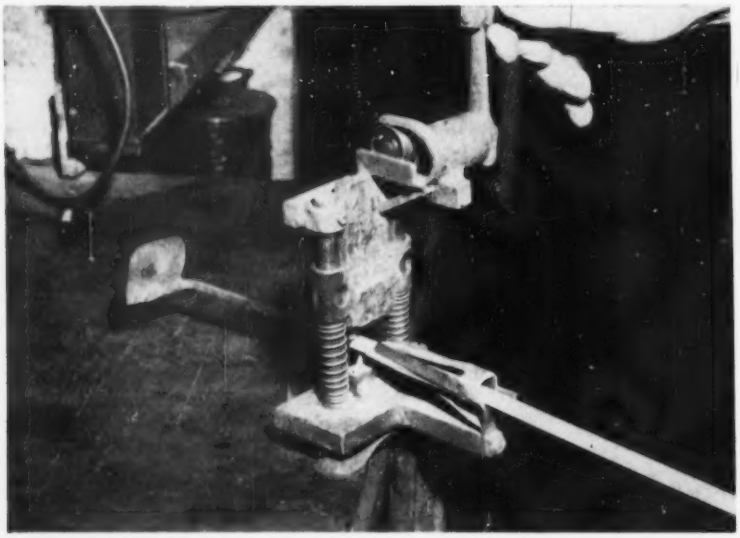
Clamp-on Wedge Cutter Is A Handy Bench Tool

Cutting insulating wedges for motors is a simple and speedy chore at Monarch Electric & Supply Company in LaSalle, Ill., thanks to the ingenuity of shop mechanics and the constant vigil of Monarch president, Ross E. Waite, for new time-saving shop ideas. Among the numerous shop kinks, both simple and complicated, developed in his shop is a handy wedge-cutter that can be clamped on any workbench.

The hand-operated unit uses the guillotine principle with a movable top blade plunging down over a stationary bottom blade with the wedge insulation between them. The shearing action produces a perfectly smooth, even out. Both blades are shallow V-shaped to match the pre-formed insulation strips; both can be removed for sharpening or replacement. The base plate of the cutter assembly is welded to the top of a C-clamp for quick installation on any workbench overhang.



CLAMP-ON CUTTER fits any bench overhang; has carefully aligned movable and stationary V-shaped blades which shear pre-formed wedge insulation in smooth, clean, manner. Stop-bracket in foreground can be set for any desired wedge length.



BLADE PLUNGER is actuated by hand crank with ball bearing on eccentric mounting. Springs on uprights return blade to normal position. Note three-pronged retainer which holds insulation firmly against steel guide finger.

Vertical movement and blade alignment are provided by two steel rod uprights on which a plunger rides. A heavy steel bracket at the top of the rods supports a hand crank equipped with a ball bearing on eccentric mounting. As the crank is turned, the bearing moves downward, pressing the plunger, against spring resistance, until the blades cut the wedge. As the bearing returns to near-center, the springs raise the plunger and upper blade to normal position. Wedge insulating is fed continuously as the crank is turned.

An adjustable stop bracket can be set to any desired wedge length. A three-pronged spring-steel retainer assembly holds the insulation firmly against a steel finger which guides it into the blade position. The mechanic need only feed the insulation with his left hand until it hits the pre-set stop and turn the crank with his right hand. After the cut, the cycle is repeated. From then on it is merely a question of synchronizing crank operation with the hand feeding of the wedges. A little practice and amazing speed and accuracy can be acquired.

Scale Method Of Winding Field Coils

Does it pay to count the number of turns when winding field coils? Can coils be wound faster, and with comparable accuracy, by determining the weight of magnet wire in a coil and using that as the criterion? These two questions are frequently raised in motor repair shops. Some operators use the "turn" method; others prefer the "weight" method.

Sievert Electric Co., Inc., Chicago, tried the "weight" method and found they could save considerable time on field coil winding and still remain within the established limits of accu-

PAYS FOR ITSELF IN ONE JOB!

HYPRESS

Cost comparisons by Busch Bros., Inc., electrical contractors for New Jersey's new Linwood Park Housing project, showed savings on Hydent connectors, (against cast connectors) more than paid for the Hypress.* On future jobs, savings will amount to more than 80% of former connector cost. Even against the most economical type of bolted connector, savings will average 40%–50%.

Write for Burndy Hydent Catalog Y53 and find out how you can connect with savings.

*Itemized cost comparison on request.

BURNDY

NORWALK, CONNECT. FACTORIES: New York, California, Toronto **TORONTO, CANADA**
EXPORT: Philips Export Corporation

53-9

"A shipyard is a graveyard we need top quality

says **INGALLS SHIPBUILDING COMPANY,**
world-famous shipbuilder, Pascagoula, Mississippi

At this vast shipyard, Ingalls has 1200 welding machines, and 1000 welders to man them. The Amerclad Welding Cable is run at top amperage 16 to 24 hours a day. It is dragged over razor-edged steel scrap and battered under heavy loads. It comes into contact with fresh welds while they are still red hot, and it is constantly showered with flaming slag from the burners' torches.

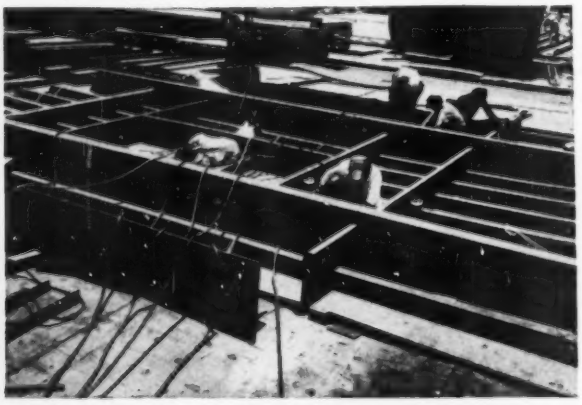
Mr. C. A. Guynn is the Master Mechanic at Ingalls in charge of all maintenance and service. He says this: "We're an all-welded shipbuilder, and we can't stand lost production time due to faulty cable. Our cable has to withstand heat and abuse, and it has to be *flexible*. An extra-flexible cable like Amerclad is easy on the welder's wrists, and it lasts *twice* as long as cables that lack this feature."

This great shipyard uses 60,000 feet of welding cable a year. But whether you use 60,000 feet or 600; whether you need a rugged cable for welding machines, power shovels or electric hand drills—there's a tough Amerclad design to give you the very best service life.

Send the coupon for more information about U·S·S Amerclad.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Ingalls uses lots of Amerclad for portable power tools. Here, it powers a half-inch electric drill used to bore 6-inch shoring timbers.



This is a typical shipyard operating condition. The cable is exposed to all kinds of weather, and dragged over sharp steel plates and beams.

A STANDARD CABLE FOR

▼ asbestos wire and cable ▼ shovel & dredge cable
▼ paper & varnished cambric cable
▼ aerial, underground & submarine cable

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WIRE & CABLE

USS

SEND THE COUPON

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Cleveland 13, Ohio

☐ Please give me more information about Amerclad.
☐ I'd like to talk to your representative.

Name .....

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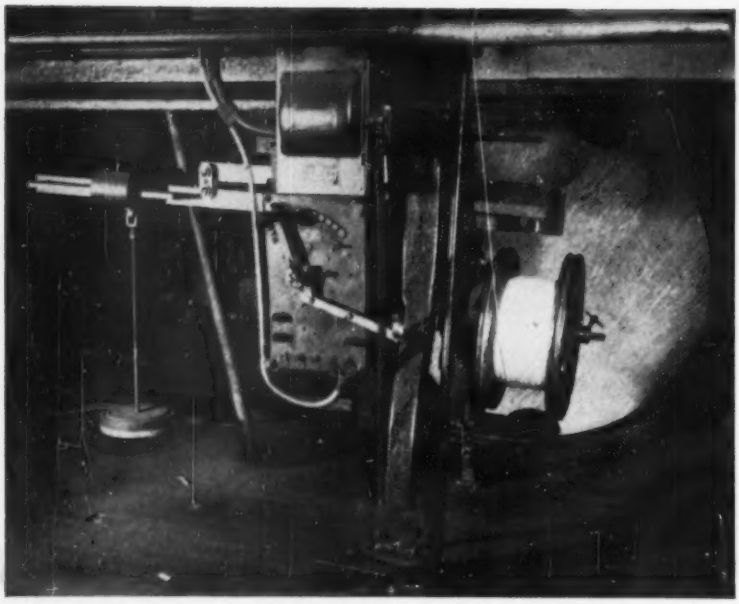
Address .....

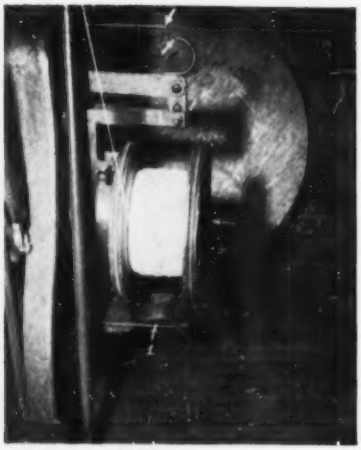
City ..... State.....

UNITED STATES STEEL



BEAM SCALE on winding machine has reel spindle and coil platform at right; weight supports at left. Scale is balanced with reel of wire before old coil is added. Control equipment is for overhead d.c. motor drive.

FIELD COILS ARE wound on basis of copper weight rather than actual number of turns in Sievert Electric Company shop. Method is fast and accuracy is within one-fourth of one percent. Machine also has turn counter.



OLD COIL ADDED to platform (1) unbalances scale in amount equal to weight of copper in coil and separates pointers (arrows). As wire is de-reeled onto new coil, gap closes. When pointers are in alignment, weights are equal.

racy. Comparison with a turn counter on the winding head proved this method to be accurate within one-fourth of one percent.

The wire is weighed automatically as th eld coil is wound. To do this, Siev.. mounted a counter-balance type scale under the winding machine base. A platform and reel support is added to the end of the scale beam directly under the winding head. The other end has facilities for adding weights.

Before a mechanic winds the coils, he mounts the magnet wire on the reel support. A brake-band device on the reel spindle permits tension adjustment for wire pay-out. Weights are then added to the other end of the beam until the weight of the wire reel is perfectly counter-balanced. When this occurs, two pointers—one on the beam and one permanently welded to the base frame—are in perfect horizontal alignment. The old field coil, with outer insulation removed, is then placed on the platform under the reel. The scale is now out of balance and the pointers separate. The weight differential is the weight of copper wire in the old coil.

Now the mechanic starts to wind the new field coil. As the magnet wire is de-reeled, the weight on the right side of the scale decreases and the gap between the two pointers gradually closes. When the pointers again are in perfect alignment, the weight of the copper on the new coil equals the weight of the copper in the old field coil on the platform. The method is as simple as that.

A wide range of winding speeds is provided by an overhead variable-speed direct current motor plus spindle pulleys to adjust ratios. Mechanics control motor operation by a foot-operated brake.

Multiple-Spindle Rack For Magnet Wire Spools

Where to store small magnet wire spools and where to mount them for payout during coil winding operations poses a problem in most motor repair shops. They can be racked along a wall on shelves, mounted to de-reeling pedestals when used, then returned to the shelves. Or, they can be permanently stored on a combination device which also acts as a de-reeler.

Lakore Electric Company, Winona, Minn., chose the latter scheme for handling magnet wire spools in the small motor repair department. The superintendent designed and built an 8-spindle, rotating, ferris-wheel type of payout rack on which up to 32 6-in. diameter spools can be mounted. Actual rack capacity depends upon the size of wire spools used.

Two 26-in. diameter, octagonal end-plates of ¼-in. steel plate form the sides of the wheel. These are welded to two floor-couplings mounted to a sturdy shaft. Through-bolts with 16-in. long spacer tubes separate the end-plates and provide additional bracing. Holes at each point of the octagonal perimeter seat rods which supports the reels. Cotter pins keep the rods in place.

The wheel rotates in hard wood pillow blocks mounted 16½ inches above floor level on a 1½-inch angle-iron frame. Base dimensions are 24 inches (length) by 23 inches. Normal position for the unit is several feet in front of the winding machine so the operator can stand between it and the winding head. The wheel-rack is turned until the desired group of magnet wire reels face the machine. It is locked in place by a spring bolt which extends through a hole drilled in the end-plate some two inches below each reel spindle. This stop-bolt is bracket-mounted to the top of the supporting frame.

The free-standing frame is not bolted to the floor. Its perfect balance

ANACONDA FORUM
for the Electrical Industry

ELECTRICITY FOR BETTER LIVING

by M. E. Skinner,
Vice President and Director of Sales,
Union Electric Company of Missouri,
St. Louis, Missouri

EVERYONE connected with the electrical industry has an obligation to exert some effort continuously to expand the future market for electrical goods and services.

There are many ways of carrying on such a program, but I know of none more basic and constructive than the promotion of more Adequate Wiring.

Notice I said *More* Adequate Wiring, for there never was and probably never will be a house that could permanently qualify as adequately wired.

NEW USES FOR ELECTRICITY

We must recognize that new uses for electricity are developing at an amazing rate and that public acceptance of the electrical way of life is steadily increasing the demands placed upon the wiring system in every American house.

Most of the things that electricity does for us cannot be done satisfactorily, or in many cases at all, with any substitute form of energy. For example, you cannot enjoy a television show except with the help of electricity. As a result, I am sure that no television receivers remain unsold because of inadequate wiring.

However, many thousands of homes are not enjoying their television as they should because of inadequate wiring. People in these homes obtain mediocre performance from their sets and are unable to do other things at the same time the set is on because a lamp or some other appliance has to be unplugged to make way for TV.

INADEQUATE WIRING MEANS LOST SALES

In the case of appliances whose function can be performed by some other form of energy, such as gas, our electrical industry is paying a heavy penalty in lost sales opportunities because of inadequate wiring.

We all know how difficult it is to portray these future possible uses of electricity—to a customer who is not now enjoying them—with sufficient force and reality to convince him, when he builds or buys a new home, of the necessity of investing now in sufficient copper, convenient outlets and switches to provide for the inevitable future which lies before him.

Maybe we never can, but we should be able to convince him of the importance of a basic foundation which will enable him to add to and expand his wiring as the need develops without tearing the house apart and starting over.

REQUIREMENTS FOR GOOD WIRING

Entrance capacity to provide for future needs, availability of 230 volts at the panel for future additions of heavy-duty appliances, enough circuits so that there is some room to grow, a distribution center from which additional circuits can be readily taken off, and copper large enough so that you don't blow a fuse every time you start a room cooler —these are the foundations for a wiring system that can be adequate today and can be kept up-to-date as we progress toward Better Living Electrically.

MONSANTO ENGINEER OUTLINES PROGRAM FOR KEEPING INDUSTRIAL POWER FLOWING

ON THE NEXT PAGE, Charles E. Knight plant engineer since 1948 for the Springfield, Mass. headquarters of Monsanto Chemical Company's Plastics Division, discusses the details of a well-rounded maintenance program for industry. Hard-working, likable, Mr. Knight has risen in only a decade with Monsanto from draftsman to his present important position. He was graduated from Mass. Institute of Technology in 1926, with a B.S. degree in mechanical engineering.

MAINTAINING

Electric power is a basic making the distribution

by C. E. Knight

PLANT MAINTENANCE and electrical engineering officials are best qualified to counsel management on present and future electric power needs.

ELECTRICAL power is one of the most important raw materials in modern industry, particularly since its use and distribution is not limited to a few departments, but is plantwide. As a result, an interruption in the delivery of this important raw material to any department can cause a major interruption of production. Enlightened plant management recognizes this fact and emphasizes the proper management of the organization charged with the responsibility for providing and distributing electrical power. This responsibility is normally assigned to a utilities group which is a unit of the Plant Engineering department. Regardless of the organizational position of the utilities group, it is essential that they be completely familiar with and consulted on any policy changes that effect changes in the use of electricity. Sales forecasts and long range expansion plans should be available for predicting loads.

The responsibilities of the Utilities Group are, in a broad sense, to provide the necessary electric power where needed throughout the plant; to be prepared, when an interruption occurs, to re-establish the supply by immediate repair of deranged equipment or use of auxiliary equipment; to keep informed of long-term planning as it affects requirements for electric power, transformers and distribution equipment and take timely steps to fulfill increased demands.

FUNCTIONS OF UTILITIES GROUP IN PLANT ENGINEERING

In discharging this responsibility, the functions of the Utilities Group are divided into four major categories (1) Routine Maintenance (2) Preventive Maintenance (3) Preventive Engineering and (4) Long Range Planning. Because there is considerable overlap in these categories, a brief discussion of each phase may be helpful.

(1) ROUTINE AND BREAKDOWN MAINTENANCE

This is the normal daily repair work that must be done, including major repairs resulting from breakdowns. Prerequisites for adequate coverage here are: complete drawing files; specifications for all transformers and distribution systems; a trained group of electricians completely familiar with electrical equipment and distribution systems; an adequate supply of spare parts.

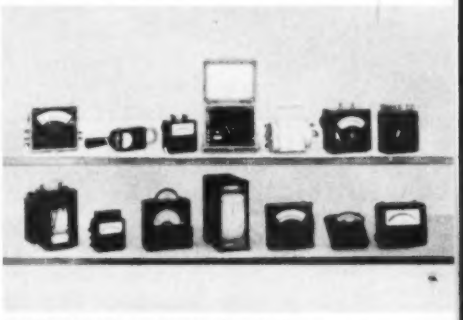
(2) PREVENTIVE MAINTENANCE

The elements of a sound preventive maintenance program are familiar to all. It is essential that this program be carried out in an orderly manner and that the responsibility for its continuation be fixed. Check lists and periodic reports are a "must." These should include such things as visual inspection of poles, insulators, manholes, condition of contacts in switch gear; filtering of transformer oil; checking relay performance by test tripping; megging feeders to determine insulation conditions; inspection of switch rooms for physical condition and cleanliness.

The installation of either meter mounts or installed meters for checking loads on critical feeder lines directs attention to overloading and will help prevent voltage loss, excessive heating and attendant insulation breakdown.

Periodic adjustment or replacement of equipment, based on failure frequency reflected in the Repair History (part of the preventive maintenance program) will go a long way toward reducing costly, unexpected breakdowns.

Where continuous operation, such as is found in the petroleum and chemical industries, makes arbitrary maintenance shutdowns financially unattractive, these inspections, replacements and adjustments must be integrated into a flexible program that can be put in motion whenever production schedules or operating emergencies dictate a shutdown.



INSTRUMENTS UNCOVER electrical system deterioration and obsolescence. The number required varies with system complexity. Here are a few used by industrial service firms.

(3) PREVENTIVE ENGINEERING

One of the most effective means of avoiding interruption of electrical service is the engineering of each change or addition to reduce the possibility of breakdown. Not only should new installations be so engineered but existing installations must be continuously studied in the light of experience and changing conditions to minimize the chance of failure. This function is one of the important duties of the Electrical Engineering group. In the location of feeders and distribution lines, such

FULL ELECTRIC POWER IN INDUSTRY TODAY

raw material for *all* industries. Here's a sensible program for system safe, adequate and less liable to costly breakdowns.

Plant engineer at the Springfield, Mass. headquarters of Monsanto Chemical Company's Plastics Division

factors as the corrosive qualities of the soil (or the vulnerability of overhead lines), location of future buildings, and probability of increased demand must be considered. The type of insulation used on feeder lines should depend upon local conditions.

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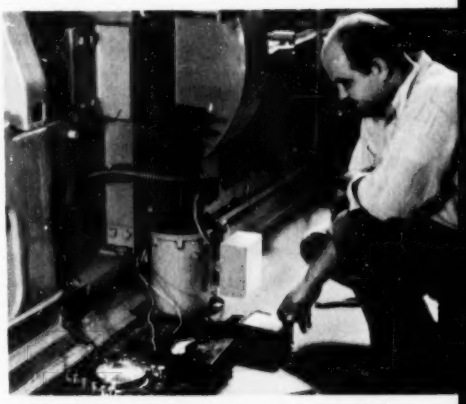
Since most electrical distribution equipment has a relatively long life and is less subject to obsolescence than manufacturing equipment, it is generally good management to use the highest quality equipment obtainable. A few dollars saved may be wasted many times over as a result of a service interruption. Choice of cable is a practical example of this, since the cost of a cable failure, considering downtime and replacement, will probably nullify the "saving" realized in an installation of inferior quality.

Standardization in the design of distribution systems and switch gear reduces the spare-part inventory and can result in substantial savings during alterations. The use of several transformer stations, each protected with suitable interrupting switches, tends to localize emergencies. These are but a few of the ways in which a qualified electrical engineering staff can and must aid in insuring uninterrupted supply of electrical power.

(4) LONG RANGE PLANNING

It is in this field that a plant's electrical engineering group must function as an integral part of plant management and be a part of the policy-making group where production operations and their power requirements are concerned. Forecasts of power requirements based on sales forecasts and long range expansion plans must be established and revised periodically to provide the hypothesis for engineering studies of modifications to meet anticipated needs.

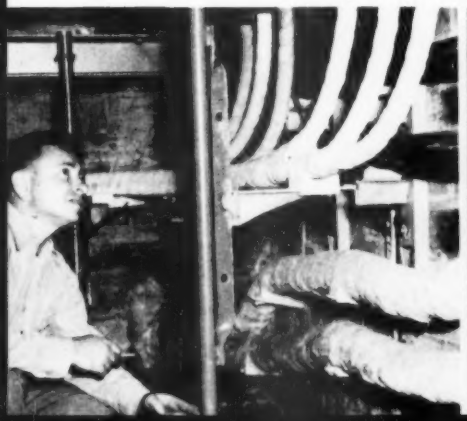
This approach avoids the frequent difficulty of a distribution system growing "like Topsy," which eventually necessitates a complete and costly replacement of the entire system or inefficient use of existing equipment. Any modifications or additions to the existing system are made to allow for future requirements. The installation of manholes or feeder ducts can be made with provision for additional capacity when needed. Switch rooms and sub-stations are built so that they are of sufficient capacity or can be enlarged to handle future needs. Although electrical distribution equipment has a relatively long life, it is often made prematurely obsolete by plant expansion. The above approach can tend to minimize this problem.

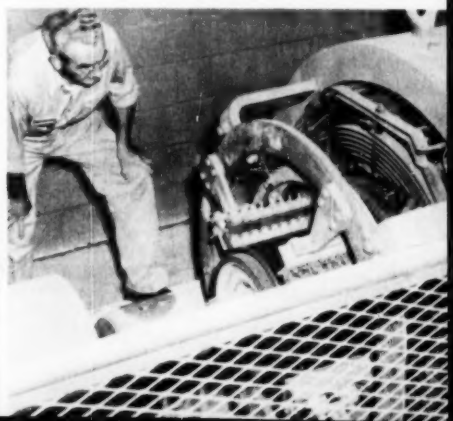


LOAD TESTS frequently uncover mechanical defects that overload motors and cause failure.

(—continued on next page)

PREVENTING COSTLY SHUTDOWNS. At Monsanto Chemical Co. inspection plays a big role in keeping power flowing. Here electricians regularly inspect such vital parts of the system as the distribution lines in a power tunnel and the main primary breakers in a substation. Even the brushes on a 700 hp. motor-generator are checked.





(—KNIGHT, Continued)

KNOW YOUR UTILITY, CONTRACTOR AND EQUIPMENT SUPPLIER

Woven through the entire program for providing uninterrupted distribution of electrical power, both for current operations and for future expansion, must be the relations with the utilities company, the electrical contractor and electrical equipment supplier. In spite of the best-laid plans, emergencies will occur during which the services of any or all of these can be invaluable. In long range planning, their experience and knowledge of factors not a part of plant operation can frequently aid in formulating a more sound program. It is important that the plant electrical engineering group establish and maintain friendly relations with these organizations.

WHAT UNINTERRUPTED ELECTRIC SERVICE REQUIRES

In summary, the importance to the plant, of an electrical distribution system that is adequate, safe and maintained so as to avoid any interruption of power distribution cannot be over-emphasized. Providing this service requires: a staff of technically trained electrical engineers; an electrical shop with adequate tools and staffed with competent electricians thoroughly familiar with the system; a serious preventive maintenance program; a reliable supply of electrical equipment and cable both in the plant and/or available through a distributor; close liaison with top management on major fluctuations in or expansions to production activity. Integration of these points into a well-formulated program will produce the desired result.

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Aimed at large industrials, "POWER-UP—And Be Prepared" tells plant executives that NOW is the time to modernize their plant wiring systems.

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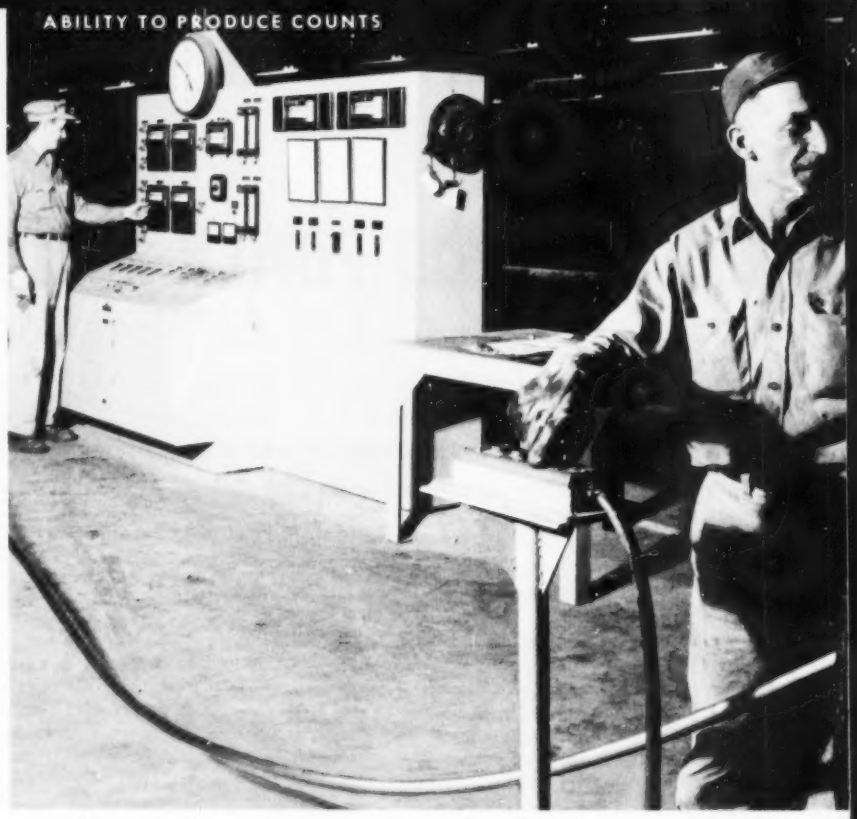
ABILITY TO PRODUCE COUNTS



Now he pushes a button

. . . and turns out a *better* cable faster

Old-time cable men—and younger ones, too—whistle when they watch this new lead-extruder at work at Anaconda. You touch a button . . . keep an eye on the instrument panel . . . and the cable rolls on the reel, ready to use. You don't stop for refills. This extruder works continuously.

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1. *delivery of products in ample quantity to meet industry's needs.*
2. *development of new products to meet new needs or to meet old needs better.*
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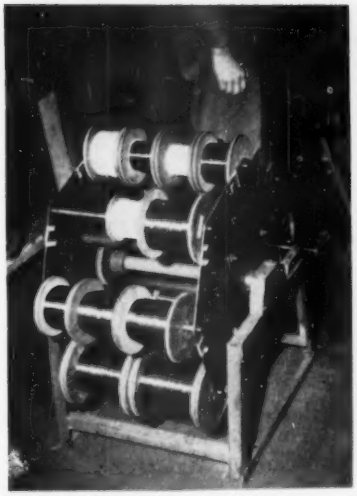
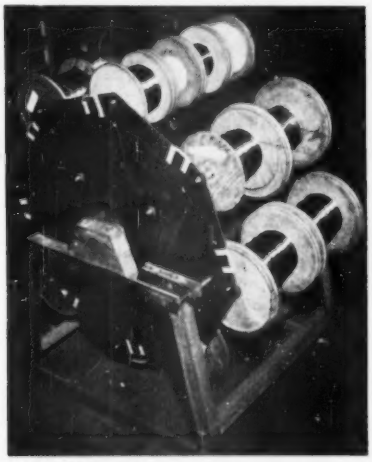


MULTIPLE-SPINDLE RACK stores and de-reels magnet wire in coil winding department. Eight spindles on rotating wheel can support up to 32 small spools.



SIDE VIEW OF rack showing spring-bolt which locks rotating wheel in place during winding operation. Wheel is turned until desired group of magnet wire spools face winding machine.

and moderately heavy weight keep it from tipping and creeping as the wire is de-reeled. If necessary, the unit can be quickly moved to another location.

Lakore mechanics like the unit, find that it speeds up coil winding operations by keeping popular size magnet wire within easy access. Time formerly spent in replacing reels on shelves is now saved.

Locating Defective Insulation

Traction motor stators are tested for insulation faults at the General Electric Company's Philadelphia service shop without disturbing insulation or connections by using a special

Every

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Before It Leaves the Factory

. . . to make sure it gives you the Best and the Most wrench service for your money

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POCKET-SIZE SNAP-AROUND VOLT-AMMETER

Measures current instantly without shutdowns or ammeter connections. Measures voltage accurately on a full-size calibrated scale; eliminates guesswork.

PICK THE RANGE THAT FITS THE JOB:

MODEL "10":	0- 10 AMPS AC.	0-125-250 VOLTS AC.
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Now every electrical man can be equipped with a snap-around volt-ammeter. The Amprobe Junior is similar to the world-famous Amprobe, except that it is built to fit a specific job at low cost. For only a few dollars more than just a voltage tester, you get an accurate voltage meter and a prized snap-around ammeter. Pays for itself by eliminating guesswork and time-wasting connections. Write for Cat. No. 132. Pyramid Instruments Corp., Dept. ECM123, Lynnbrook, N. Y. (Export Div.: 458 B'way., N. Y. 13. Cable: Morhanex).

PICK-UP COIL produces regular pattern on oscillograph when adjacent to good coil and irregular pattern when insulation fault exists.

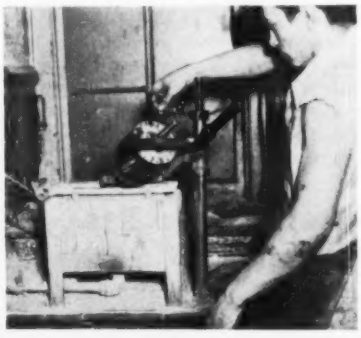
pick-up coil in conjunction with a winding insulation tester.

The equipment indicates insulation faults on traction motor armatures and stators by means of an oscillograph pattern and is accurate within 1½ inches of the exact location of the trouble.

Formerly, when it was known that a stator or armature had a fault, it was necessary to tear down the part until it was located. According to engineers at the shop, the insulation testing equipment does the job more quickly with a great degree of accuracy and ease. The apparatus also is used for high potential testing, commutator bar shorts and ground testing, bar-to-bar tests on the commutator, and surge testing.

Commutator Soldering Technique

A simplified procedure has been developed for soldering armature leads to commutators by the Penn Electric Motor Company of Philadelphia, Pa.



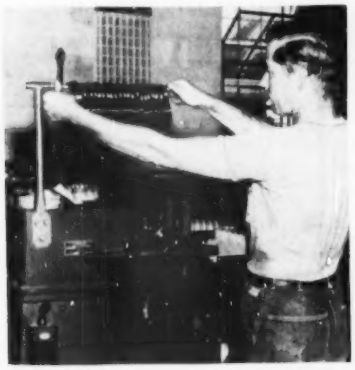
BRACKET ASSEMBLY for holding armature over solder pot facilitates soldering of armature leads to commutator.

The device used consists of an 18-inch adjustable vertical elevating arm with two horizontal brackets, assembled beside a pot of melted solder. The armature is rested on the two brackets with the commutator end over the solder. Lowering the assembly by means of the adjusting arms on the threaded vertical shafts permits the armature to be lowered until the connections of the armature leads to the commutator segments just touch the surface of the solder. Then, by manually rotating the armature, the solder reaches all the connections around the circumference of the commutator.

In addition to doing a smoother and better soldering job, this device saves more than 80% of the labor that was previously required for the same operation using a soldering iron.

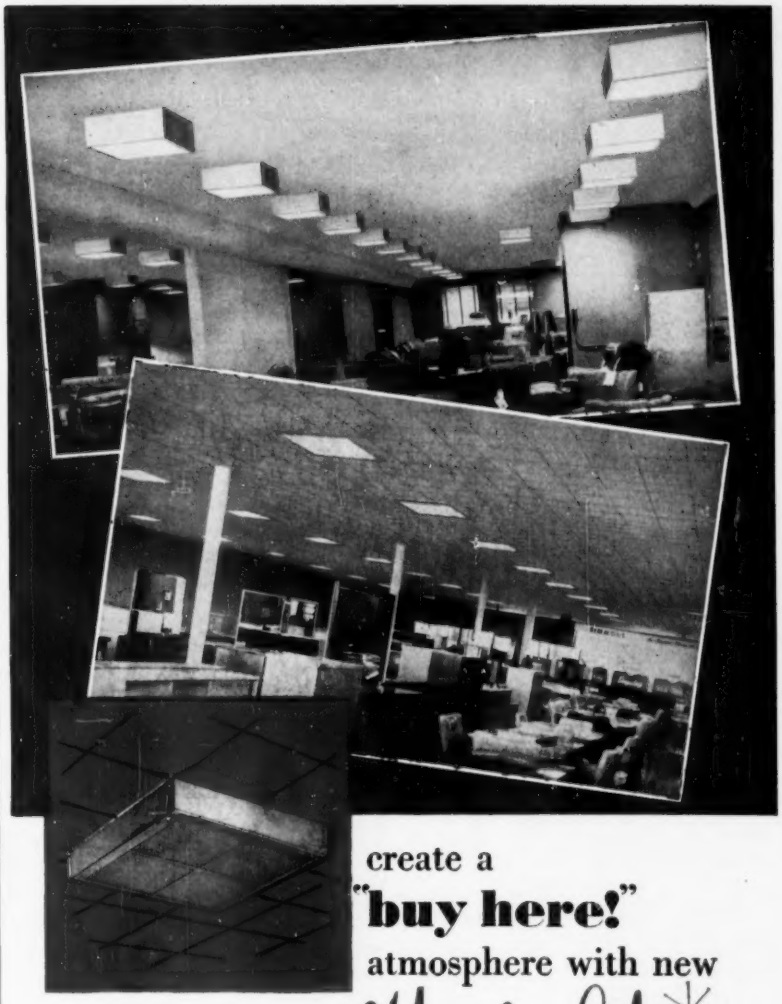
Coil Holder Saves Useless Steps

A simple coil holder capable of holding more than a dozen coils is saving many useless steps by winders employed by George Lockwood in his Trenton, N. J., motor repair shop. Formed from two 15-inch lengths of ¾-inch tubing connected at right angles



TWO TUBES, connected in the form of an inverted L and secured to the winding machine by screws passing through the flattened end of the lower tube, serve as a step-saving temporary holder for more than a dozen coils.

by means of a tee, and secured to the winding machine by three cap screws passing through the flattened end of the lower tube section, the holder is convenient to the operator. The upper or horizontal tube is sheathed by a fibre tube to protect the wound coils and to serve as a carrying agent when coils are transferred from this temporary holder to one of the winding benches. By transferring coils at greater intervals rather than placing coils on the bench one at a time, countless steps are saved.



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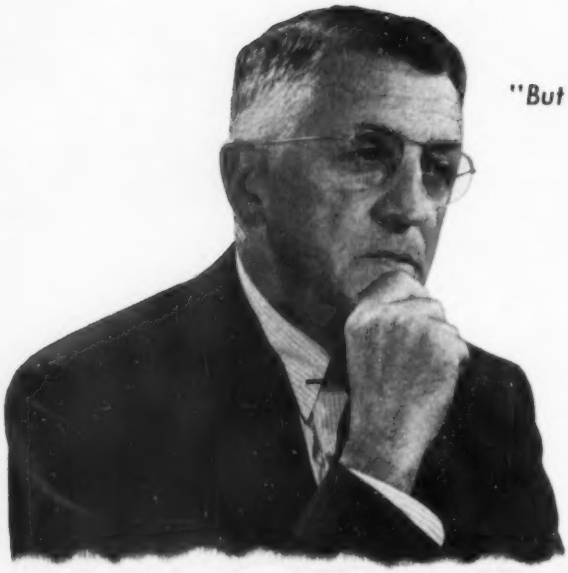
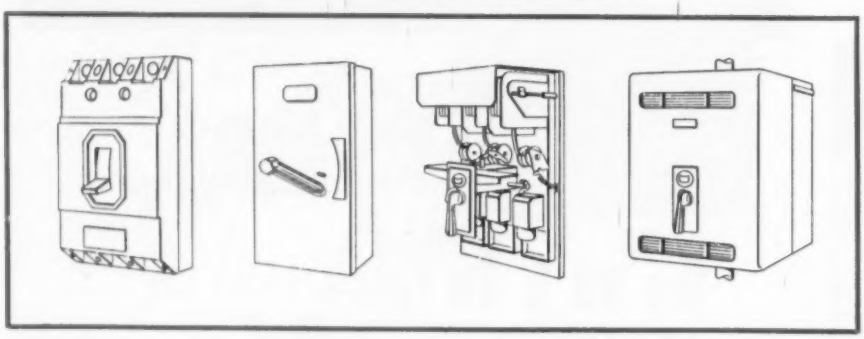


"But circuit breakers cost too much . . ."



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There are cost-saving I-T-E circuit breakers and enclosures for every application—indoor and outdoor—with auxiliary and tripping devices to fit each job.

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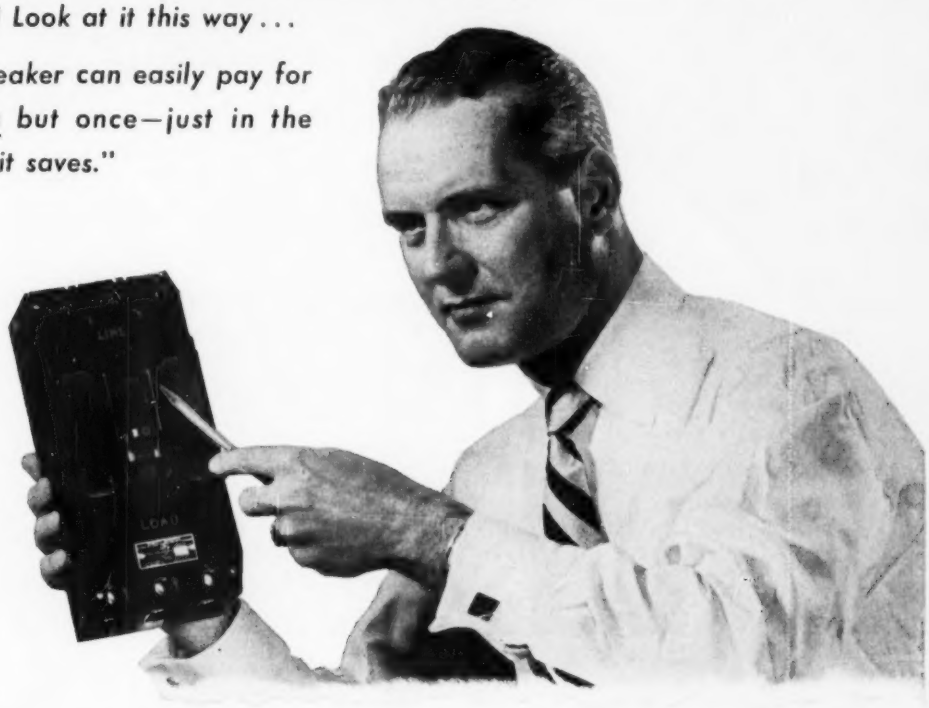
"No, Jim! A circuit breaker may be priced a little higher than the ordinary protective device—but it actually costs a whole lot less! Look at it this way...

"A circuit breaker can easily pay for itself if it trips but once—just in the production time it saves."



How right you are, Mr. Plant Engineer!

There's a big difference between initial price and over-all cost of protection. Considered in this light, circuit breakers actually *cost* less! That's because—

They reduce costly production down-time

Service restored without delay after a fault occurs. No chance for tie-ups.

They eliminate replacement costs

No need to put in a new element each time there's an overload or short circuit. And maintenance is practically nil.

They provide positive safety for personnel

No live parts exposed. Costly accidents are averted.

They're tamper-proof

Completely enclosed. Calibration cannot be altered.

They're twice-tested

Factory-tested on actual overloads to assure calibration accuracy.

They protect against single-phasing

Circuit breakers operate on the "common trip" principle—an overcurrent on any phase opens all poles simultaneously. Single phasing of motors prevented.

They carry continuous current rating—safely

The rating engraved on the circuit breaker is *true* current rating.

They save mounting space

—sometimes as much as 25%. Circuit breaker is a compact, self-contained unit—ready to mount.

They offer a wide range of special attachments and enclosures

Shunt trips, undervoltage trips, auxiliary switches, Bell alarm switches, etc., fit right inside circuit breaker. Enclosures available for any application.

They incur low watts loss

Silver-alloy contacts and corrosion-resisting plated metal parts prevent overheating... contribute to long life of circuit breaker.

I-T-E Individually Enclosed Circuit Breakers

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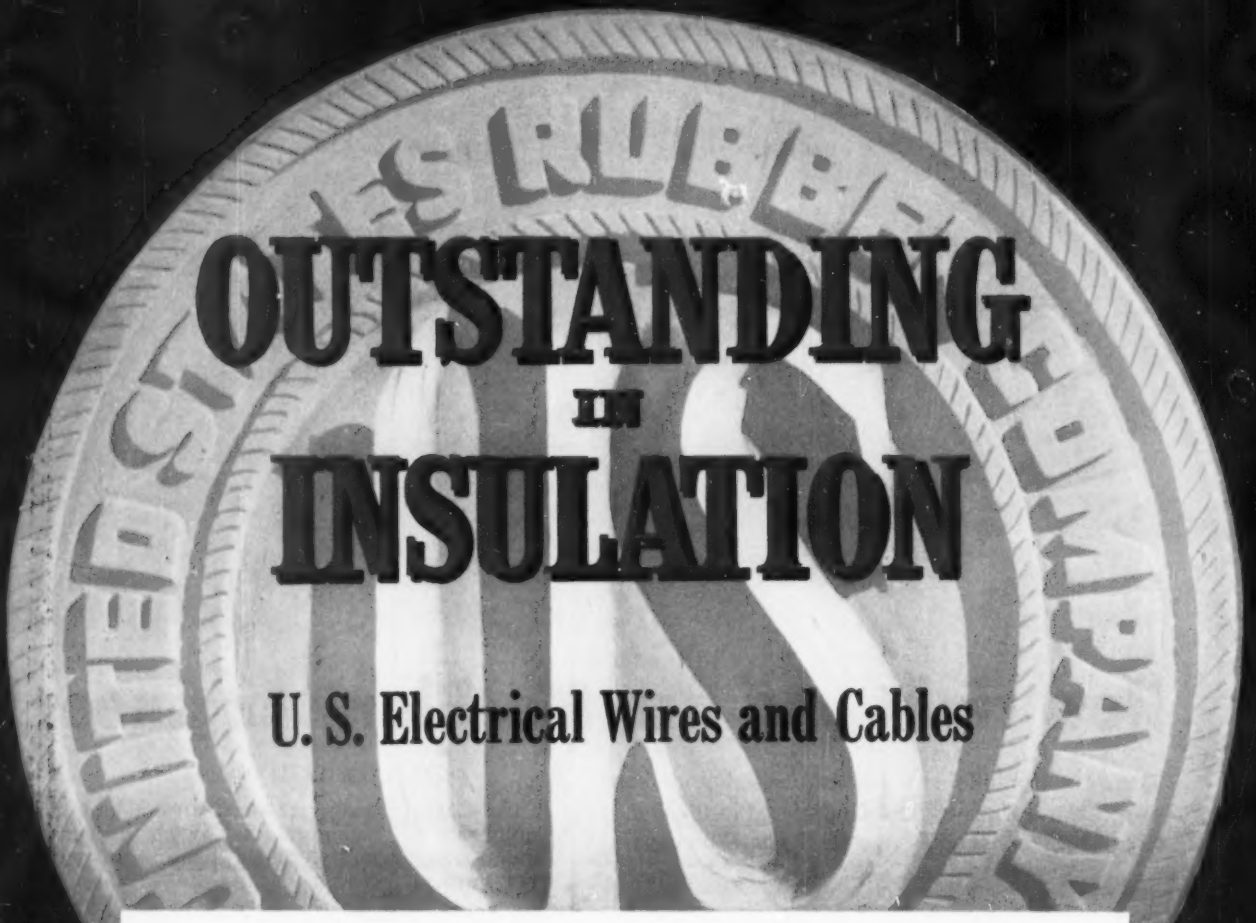

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TWISTED SERVICE DROP CABLE—Either neoprene insulated or performance insulation and neoprene jacket; copper or aluminum conductors.

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Practical Methods

IT'S A SNAP to load heavy equipment when trucks have hydraulic tail gates. Lever operated gate acts as elevating platform to raise loads from ground level to truck bed height. With a flick of a lever, this mechanic loads a tool box and reel of cable on truck.

Power Tail Gate Loads Truck

MATERIAL HANDLING

Material handling always has been a substantial item in an electrical construction operation—both in the field and at the shop headquarters. Whether the items consist of switchgear, transformers, large reels of cable, heavy power tools, or boxes filled with hand tools or conduit fittings and wiring accessories, they still have to be transported to the job. Many electrical contractors maintain a substantial inventory of such material and equipment items to get projects started on time and to ease the pressure of long deliveries on some items.

Skids, winches and hoists are still used to a considerable extent to load this equipment on trucks at the shop and unload again at the job site. The development of the hydraulic tail gate for trucks is gradually changing this picture. Now, more contractors are discarding the old, slow methods for this new, faster and safer technique.

Electrical Contractors, Inc., Chicago, is one of the electrical construction firms using the hydraulic tail gate to advantage for handling material at its storage yard. This yard is large enough so trucks can turn, maneuver and back up to storage sheds built around its perimeter, so it was a logical move to equip a three-ton truck with a one-ton hydraulic tail gate. With this built-in "elevator", a man can raise equipment from ground level to truck bed height in a matter of seconds. Once the equipment is loaded on the truck, the elevating platform continues to rise in a vertical plane to form the tail gate. The procedure is reversed when the truck is unloaded at the job site. Not only is this method quicker, but the danger of damage to equipment and injury to personnel is materially reduced.

Portable Base For Power Hack Saw

CONSTRUCTION

Power cutting is replacing hand methods on electrical construction projects, particularly where larger sizes of conduit, copper bus, angle-, channel- and flat-iron are used and where a substantial number of cuts have to be made. Most versatile of equipment items for such operations are the power hack saw and the metal cutting band saw. Some electrical contractors standardize on the band saw; others prefer the hack saw. Choice between the two is a matter of job economics and individual preference.

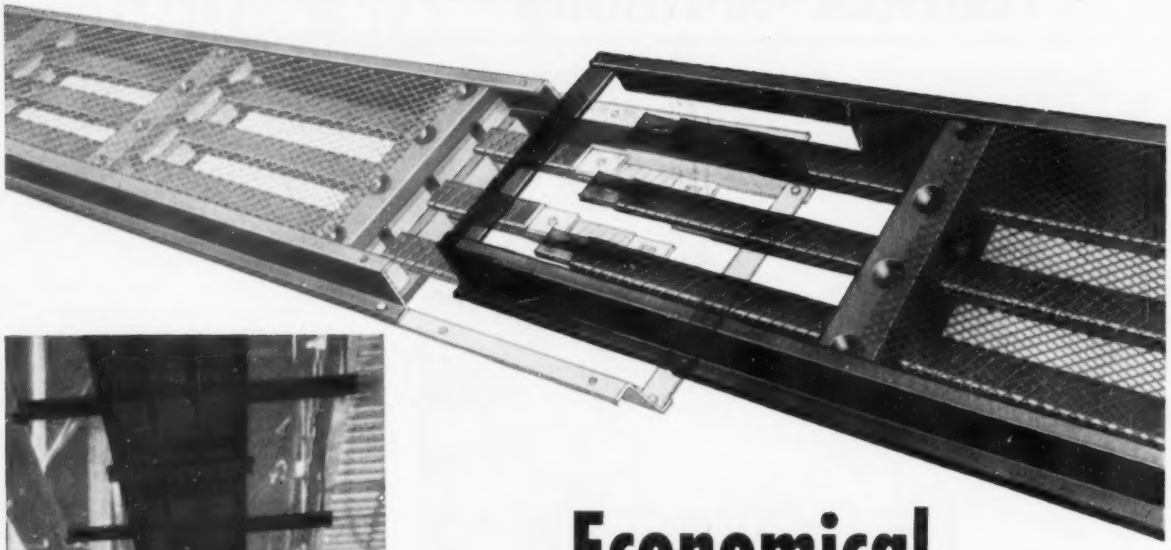
Chapel Electric Company in Dayton, Ohio, used a power hack saw on an industrial project and increased its effectiveness by mounting it on a portable base. Instead of mechanics bringing work to a central shop area, the saw was easily moved around the plant to actual points of installation.

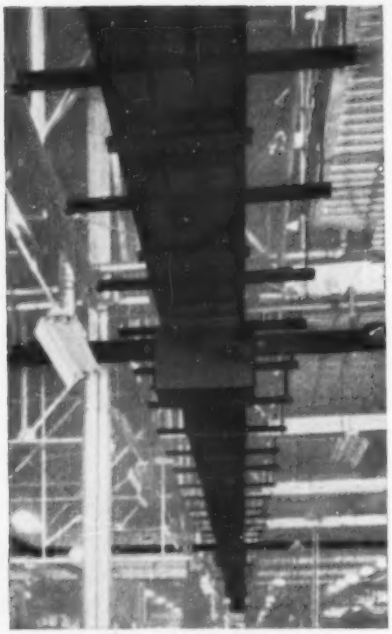
The mobile frame is of simple design and construction, consisting of a rectangular base of 2-inch angle-iron 37 inches long and 17 inches wide. Four angle-iron legs raise the hack saw 16½ inches off the floor. The two

PORTABLE FEATURES of power hack saw frame are demonstrated by John Doan, job superintendent for Chapel Electric Company. Note casters on front legs and telescopic conduit handles.

LOCKING PIN on chain retainer holds telescopic handles in extended position while saw is being moved to new location. Pin is removed and handles pushed back to original position when saw is in use.

BULLDOG BUStribution® DUCT





Prefabricated 10′ sections and standard fittings give Ventilated LO-X Duct complete flexibility. 800A. to 4000A. at 600 volts or less.

Economical
• to install
• to operate

For faster, easier, more economical installation of duct sections, BullDog LO-X BUStribution DUCT uses the scarf-lap joint—a thoroughbred engineering feature that pays off in extra savings for you.

With BullDog's exclusive scarf-lap joint (shown above), duct sections simply overlap and bolt together . . . making a stronger, more rigid assembly. Bulky, complicated joint fittings are eliminated. Savings in time and money are substantial.

Another great economy feature, BullDog's unique paired phasing arrangement, lowers reactance in the bus bars. It assures you the *lowest possible* current carrying cost per ampere per foot.

Get complete information on LO-X Duct (for feeder and welder circuits) and Plug-in Duct (for branch circuits). Consult your nearest BullDog Field Engineer —offices in principal cities throughout the United States and in Canada. Or write BullDog Electric Products Company, Dpt. EC123, Detroit 32, Mich.

© BEPCO

THOROUGHBRED IN ELECTRICAL EQUIPMENT

BULLDOG
ELECTRIC PRODUCTS COMPANY

front legs are equipped with 4-inch diameter rubber casters. Two ½-inch conduit handles telescope into 1-inch conduit guides welded to the sides of the frame at a slight incline.

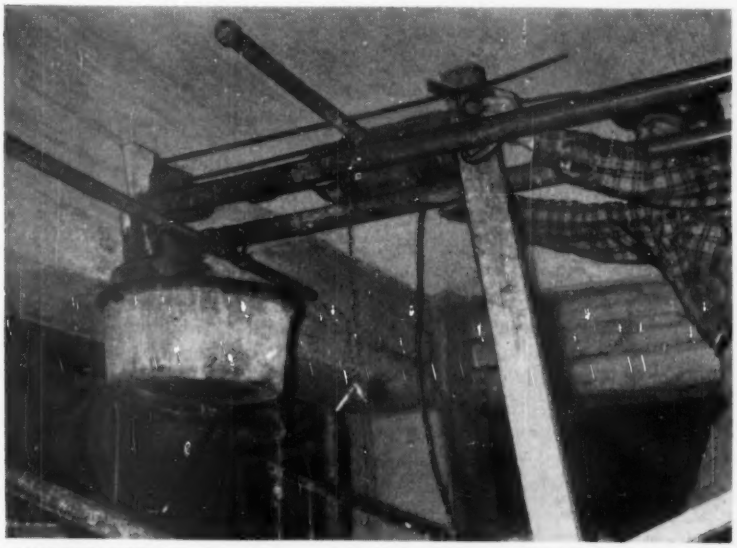
When moving the saw, the mechanic pulls the handles out a predetermined distance to secure the benefits of additional leverage. A pin, which goes through both sections of conduit, locks the handles in the extended position. The mechanic then pushes the saw assembly in wheelbarrow fashion. When the saw is in use, the locking pins are removed and the handles returned to "closed" position. The two stationary legs at the back of the frame rest squarely on the floor and prevent creeping due to vibration and the reciprocating action of the saw.

Rig Simplifies Close-to-Ceiling Drilling

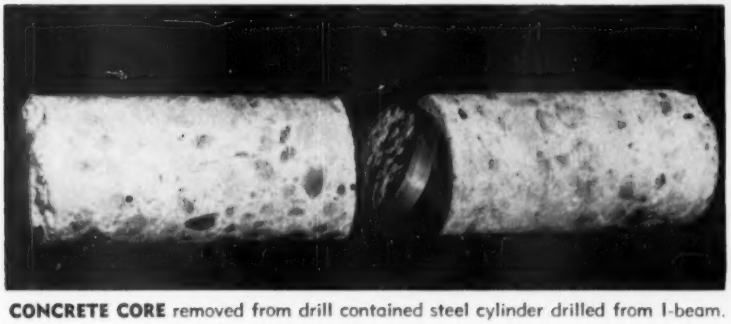
CONSTRUCTION

A drilling problem which required two four-inch holes through 15½ inches of concrete, in which was imbedded a half-inch steel I-beam, was overcome by the Bertke Electric Co., Cincinnati, Ohio, during the recent construction of the new Cincinnati Veterans Hospital. The drilling was difficult because the holes were to be located on a concrete beam a few inches below the ceiling.

The electrical contracting firm solved the problem by constructing a combination drill support and pressure rig. Skids were erected to support the 1¼-inch, 150 rpm Tilden rotary drill. A horizontal pressure bar, attached with wing nuts to two threaded rods which were anchored to the wall, provided a fulcrum for a 2 by 4 board. The board was used with one 2-inch edge against the horizontal pressure bar and the opposite edge against the drill housing. The 2 by 4 was manipulated from the floor, giving the necessary leverage to exert forward pressure on the drill. As the drilling progressed the wing nuts were tightened, thus keeping the horizontal pressure bar the correct distance behind the drill. Water was directed into the holes during the operation to flush out cutting debris and to act as a coolant.



SUPPORT SKIDS, pressure bar and 2x4 for leverage provide efficient method of drilling 4-inch holes through concrete beam close to ceiling.



CONCRETE CORE removed from drill contained steel cylinder drilled from I-beam.

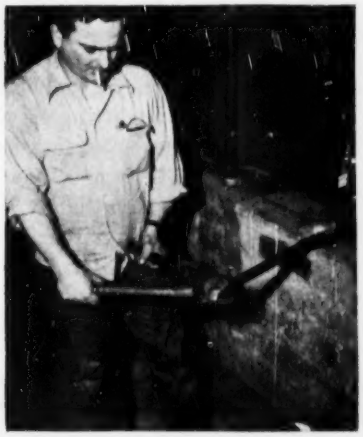
Time-Saving Lug Attachment Methods

CONSTRUCTION

Design and development of the large variety of solderless lugs and connectors now available have made it easier for the electrical mechanic to make better cable connections in far less time than ever before. Choice of specific connectors depends upon the cable connection problem at hand, specification requirements, and—to some extent—the individual preference of the electrical contractor on the project.

Among that increasingly large group of electrical contractors using a number of solderless lug types, and maintaining stocks of same, is Continental Electrical Construction Company in Chicago. In addition to standard set-screw and bolted varieties, Continental frequently uses pressure and welded lugs where job conditions permit. Both of these techniques offer enticing time-saving features as well as improved lug-to-conductor contact. Both require special tools.

Tools for the pressure-type connectors range from special hand pliers for branch circuit size conductors to hydraulically actuated high pressure hand tools and foot-operated hydraulic presses where the number of conductor connections required warrant the press investment. Critical factor in this type of connection is pressure. It must be sufficient to crimp or press the lug firmly to the bare conductor to resist loosening from vibration or natural expansion and contraction due to heating and cooling. Hence the use of a hydraulic hand tool to apply uniform high



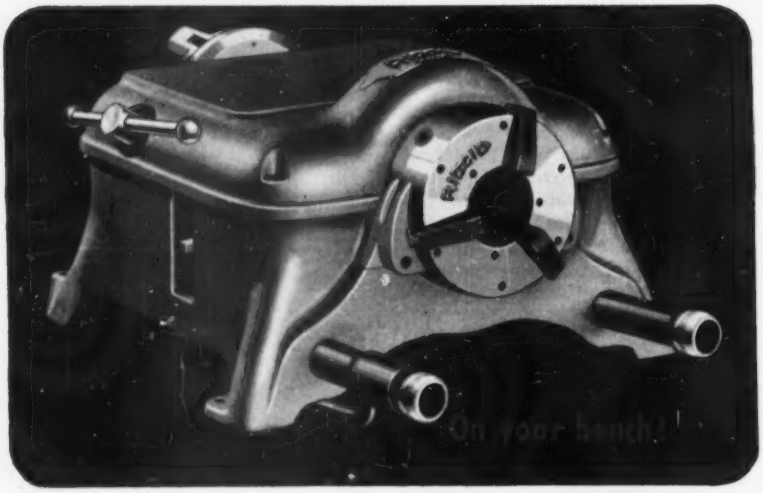
HYDRAULIC HAND PRESS transforms mechanic's hand leverage to a uniform high pressure force around this 500 MCM lug. Pressure on conductor strands increases contact area between cable strands and lug and cable to make good connection. Lug is installed in matter of seconds.

Push-button Muscle

The tough little brute of a work-saver when you've got conduit to thread, cut or ream

RIDGID

"400" Portable POWER DRIVE



It's light weight!

Portable Stand

● The last word in easily portable power to turn your conduit for threading, cutting, reaming with your hand tools — quickly pays back its cost in saved time and work. Capacity ⅛" to 2" but scads of power even for geared tools to 12". RIDGID design 3-jaw chuck, 6 pinions, one always handy. Self-centering workholder in rear. Sealed-in lubrication—no oil to spill. Famous RIDGID "guts" in it—scores of thousands in use. Try it, buy it—at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools

CRUCIBLE WELDING technique uses graphite crucible with hand clamp to hold cable and lug in place. Ignition of powdered metal charge in crucible welds lug and cable firmly together in less than one minute. Method is used extensively to weld ground cables to building steel columns.

pressure on large size lugs and connectors.

Crucible welding provides another quick method of making lug and cable connections. One technique, known as the Cadweld process, uses a graphite crucible with hand clamp to hold conductor and lug. A powdered metal charge of copper oxide, aluminum, and a starting powder is poured from a cardboard cartridge into the crucible after the conductor and lug have been clamped into place at the base of the crucible. The charge funnels down around the cable and lug sleeve. After the crucible cover is closed, the charge is ignited with a spark or flame. The resultant heat generated by the flash is sufficient to change the copper oxide into molten copper and to weld the cable and lug together. All this takes place in less than one minute.

The crucible welding technique, with slightly different shaped crucible, is used extensively to weld copper ground cables direct to steel building columns. Economy over the bolted lug type of connection is substantial and the mechanical and electrical properties of the connection have a stability which only welding can provide.

Radiant Heaters Speed Drying Operations

EQUIPMENT

An inexpensive far-infrared electric heating installation has speeded up drying of metal parts for Unistrut Corporation, at Wayne, Michigan. Drying of these pressed steel fittings after washing and bonderizing is now accomplished with 12 Chromalox electric radiant heaters installed in an oven formed of insulated panels with

CLARK CONTROL CENTERS

are *easier to install* easier to service easier to add to, or alter

Centralized grouping of motor control contributes to efficient operation of many modern industrial plants. *CONTROL CENTERS* by *CLARK* have many features that provide the maximum benefits obtainable. For example:

Separately enclosed 6-inch wide vertical wireways for each vertical section are accessible without opening compartment doors. This feature means easier installation and maintenance.

Safe-edge compartment doors eliminate dangerous sharp edges and corners. Door handles are interlocked with disconnect switches or circuit breakers.

Frame is rigidly constructed in double-box style, of sturdy welded channel sections, capable of withstanding heavy blows without destroying alignment.

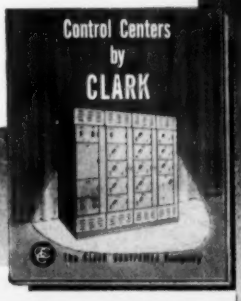
All Control Equipment is accessible and removable from front. Connections and wiring are all done from the front, and all equipment is accessible without removal from compartment.

Each compartment is an integral unit, independent from frame and, in practically all sizes, is completely removable, with plug-in connections. This provides maximum flexibility.

Uniform neat appearance of compartments, in a complete range of sizes, permits an almost infinite variety of combinations.

In NEMA Type C construction, Clark Control Centers permit terminals to be located in top and/or bottom or in vertical wireways.

The use of standard factory-assembled components throughout eliminates special engineering, saves time and money in installations.



CONTROL CENTERS by CLARK, are completely CLARK designed, CLARK engineered and CLARK built, for continuing reliability and uniformity.

Send for your copy of the factual book "CONTROL CENTERS by CLARK"

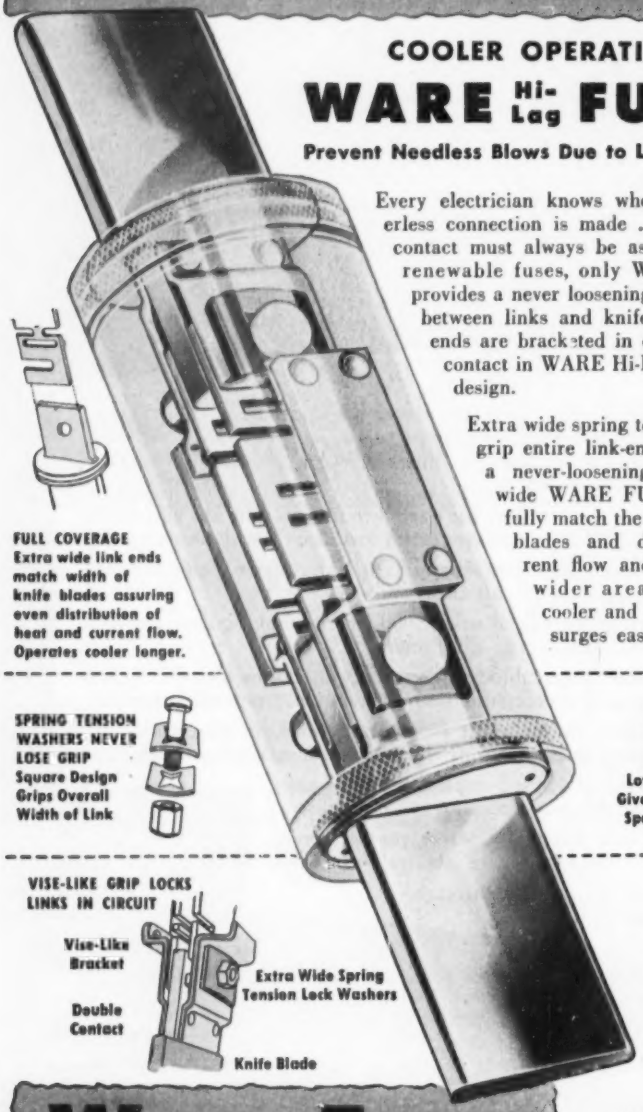
ENGINEERED ELECTRICAL CONTROL

THE CLARK CONTROLLER CO.

1146 EAST 152ND STREET, CLEVELAND 10, OHIO

Perfect Contact Always

Between Links and Knife Blades



COOLER OPERATING

WARE Hi-Lag FUSES

Prevent Needless Blows Due to Loose Contact

Every electrician knows whenever a solderless connection is made . . . that tight contact must always be assured. Among renewable fuses, only WARE Hi-Lag provides a never loosening *vise-like* grip between links and knife blades. Link ends are bracketed in double surface contact in WARE Hi-Lag's exclusive design.

Extra wide spring tension washers grip entire link-end assembly in a never-loosening grip. Extra wide WARE FUSE link ends fully match the width of knife blades and distribute current flow and heat over a wider area. Links stay cooler and absorb sudden surges easier.

FULL COVERAGE
Extra wide link ends match width of knife blades assuring even distribution of heat and current flow. Operates cooler longer.

SPRING TENSION WASHERS NEVER LOSE GRIP
Square Design Grips Overall Width of Link

WARE Hi-Lag FUSES
Lower Your Costs
Give Full Protection
Speed Production

VISE-LIKE GRIP LOCKS LINKS IN CIRCUIT

Vise-Like Bracket

Extra Wide Spring Tension Lock Washers

Double Contact

Knife Blade

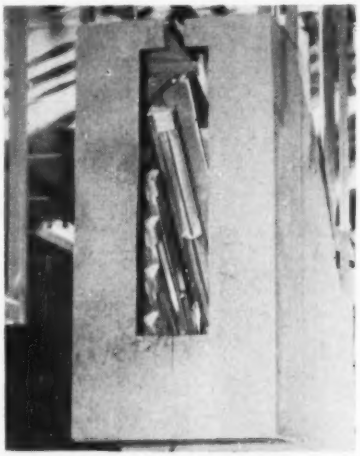
SINCE 1915
WARE fuse engineering dates to 1915. Now WARE is internationally accepted for best protection and performance.
UNDERWRITERS APPROVED

Ware Fuse CORPORATION

GUARANTEED TO MEET THE SEVEREST TEST
Write for Prices and Name of Distributor Nearest You

4410 WEST LAKE STREET • CHICAGO 24, ILLINOIS

ELECTRIC OVEN in plant of Unistrut Corp., Wayne, Mich., uses 12 Chromalox far-infrared electric radiant heaters of 1800 watts each. End view shows metal parts being dried.



RADIANT HEATERS are spaced on 8-inch centers, with six on each side, mounted on Unistrut frame and enclosed by insulating panels with reflective aluminum sheet inner lining.

inner lining of reflective aluminum sheet.

The radiant heaters are each rated 800 watts and are installed six on each side of the oven tunnel on 8-inch centers, mounted on Unistrut framing.

With a conveyor speed of six feet per minute, 3000 pounds of brackets, angles, channels, clamps and similar parts are dried per hour. Insulation and the reflective aluminum retain heat in the oven and increase the drying efficiency.

The escalator type oven used here is rather unusual, but well suited for the job being done. It demonstrates the adaptability of the all-metal radiant heaters which are mounted at an oblique angle that assures even absorption of heat by the passing work.

Accurate heat regulation for vary-

FOR ELECTRIFYING RESULTS

CADWELD®

Design and field electrical engineers rate CADWELD the finest electrical connection on the market. Here are the reasons WHY!!!

1 CADWELD connections have more current carrying capacity than the conductor itself.

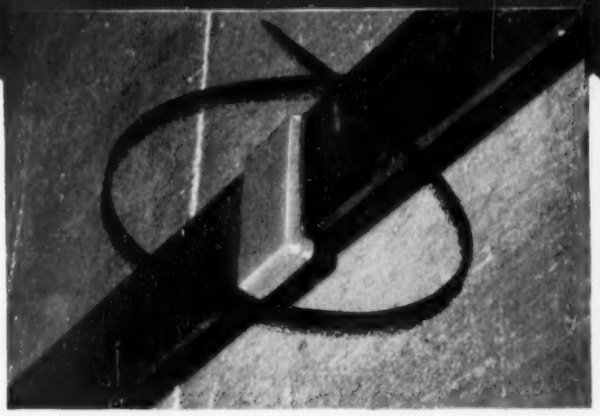
2 CADWELD connections cannot loosen or corrode.

3 Any shape or size conductor (copper or steel) can be CADWELDED with standard equipment.

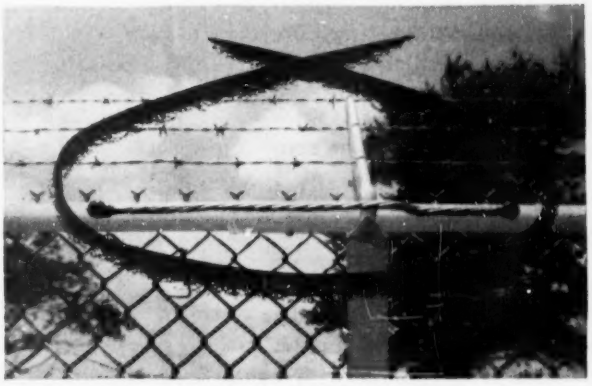
4 Single CADWELD cartridges or combinations can be used for all size connections.

5 Equipment is portable — perfect for field use—no outside source of power or heat required.

For the best in
ELECTRICAL CONNECTIONS



BUSBAR ⅛" x1"—½" x 8"



CABLE TO STEEL ALL SIZES
CABLE #6—3,000 MCM

The Current Trend
IS
CADWELD
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Send for your copies *Now!*

Yes, when you send for these bulletins on popular "Buffalo" Fans, you are taking the first step to real profits! The brand-new line of "Buffalo" NV-Breezos, Heavy-Duty Propeller Fans and Belt-Air Fans have been selling even better than their predecessors which led the field for many years. They blanket a capacity range from 500 cfm to 90,000 cfm, enough for almost any ventilating application you you could name. New Breez-Air Attic Fans and Breez-Pac Attic Fan Packages, and "E" Blowers-Exhausters will round out your line for a very profitable 1954. Write today —specifying Bulletins 3865, F3790, FM-10 and FM-900.

First For Fans

BUFFALO FORGE COMPANY

520 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

PANEL BREEZO FANS BELTED VENT SETS BELT-AIR FANS
BREEZ-AIR ATTIC FANS "L" BREEZO FANS "NV" BREEZO FANS

ing part sizes is provided by variable input controllers and magnetic contactors. Controller settings can also be varied to compensate for changes in rinse temperature, ambient building temperature and humidity.

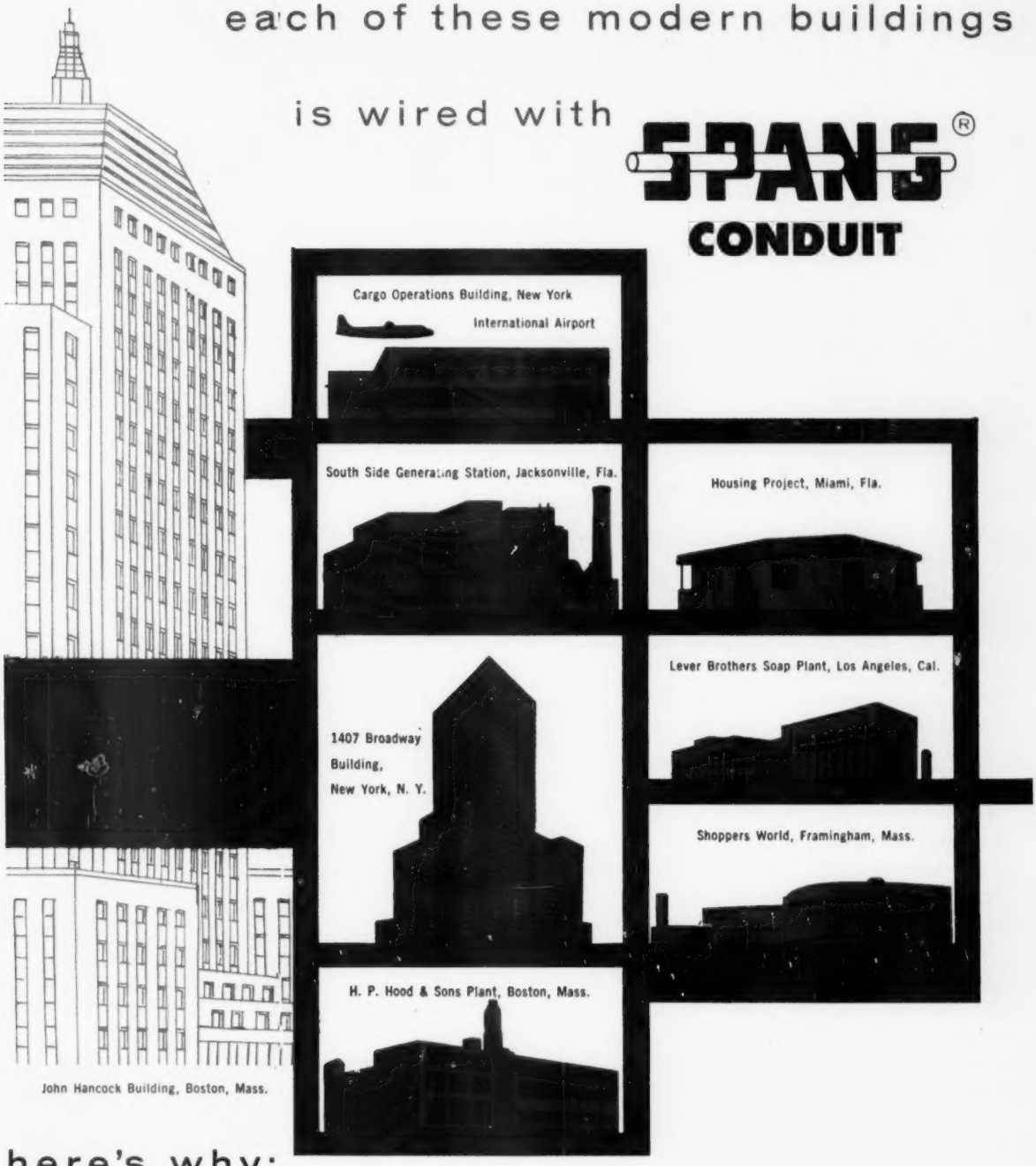
Other advantages of the installation are compactness of the oven, which saves valuable floor space, all-metal construction and long life of heating elements, which minimize maintenance problems, and low initial and operating costs.

CHUCK KEY STARTING provides safety feature on pipe threading machines used by Emerson-Comstock Company, Inc., large Chicago electrical construction firm. E-C engineers mounted limit switch in pipe collar behind chuck, connected it in series with motor starting switch. Operator must remove key from chuck and seat it in V-slot of collar to actuate limit switch before motor will start. If key is raised from collar, motor will stop. A second limit switch with actuating bar on diehead slide prevents jamming.

STURDY ANGLE-IRON RISERS support vertical runs of 1,600-amp, 120/208 volt, 3-phase, 4-wire bus duct which feed 15-floor University of California Teaching Hospital at San Francisco. Abbett Electric Corporation, San Francisco, project electrical contractor, used 3 in. by 3 in. angle for risers with bolted L-brackets welded to duct housing. At each floor, 6 in. by 6 in. angle-iron horizontal sections bridge floor opening; are bolted to vertical runners to act as floor supports to carry combined weight of duct and runners.

each of these modern buildings

is wired with SPANG® CONDUIT


Cargo Operations Building, New York International Airport
South Side Generating Station, Jacksonville, Fla.
Housing Project, Miami, Fla.
1407 Broadway Building, New York, N. Y.
Lever Brothers Soap Plant, Los Angeles, Cal.
Shoppers World, Framingham, Mass.
H. P. Hood & Sons Plant, Boston, Mass.
John Hancock Building, Boston, Mass.

here's why:

Spang Conduit is the combination of top-grade steel and quality-controlled manufacturing which gives you conduit to fit any wiring needs.

Evidence of the wide demand for Spang Conduit can be found in the many types of buildings for which Spang exclusively has been specified. Whether it's an airport, a manufacturing plant, a power plant, an office building, a home . . . no matter what the type of building . . . architects and contractors find that Spang offers the conduit best suited for their needs.

Spang is easier to cut, thread, bend and weld, saving valuable time and money on conduit installation. Take your choice of any of the "big four" in a full range of sizes. Spang offers you Cenlaco, Central Black, Central White, and EMT with the SPANGLEAM Finish.

SPANG CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
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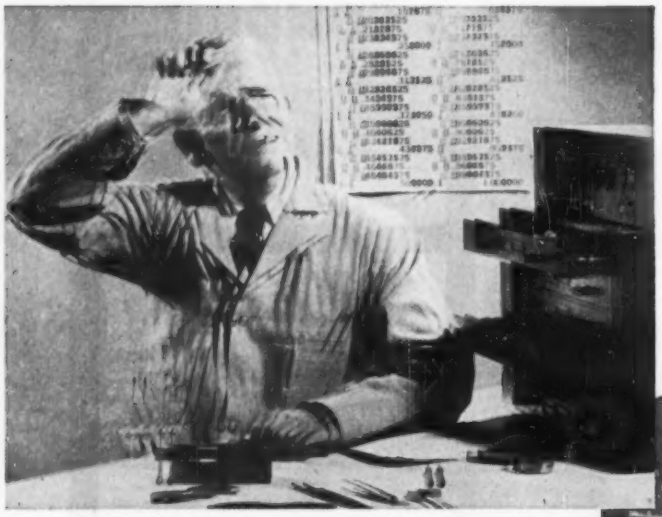
STOP annoying blink...blink...blink



WITH WATCH DOG NO-BLINK FLUORESCENT STARTERS

Annoying fluorescent blink and excessive maintenance go hand in hand. Here's what Watch Dog* starters do about it.

- Watch Dog starters *stop blinking* by automatically turning off a failing fluorescent lamp.
- Watch Dog starters *keep the lamp off* until the red reset button is pushed when new lamp is installed. No recurring blinking every time the lights are turned on.
- Watch Dog no-blink starters *outlast* ordinary starters by as much as 10 to 1. Ballasts last longer, too.

You can stop the annoying blink of worn-out fluorescent lamps—cut starter replacement costs—cut ballast replacement costs—by seeing that *all* your fluorescent fixtures are equipped with General Electric Watch Dog no-blink starters.

Specify Watch Dog starters for new fixtures—insist on them for replacement. For a copy of folder Q33-1218, which gives all the facts on the Watch Dog starter line, write Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Registered Trade-mark General Electric Company

You can put your confidence in—

GENERAL ELECTRIC

For all replacement needs—use the famous Watch Dog no-blink starter with the red reset button.

And here is the tag to look for when you buy fluorescent fixtures. It is your guarantee that the fixture has been equipped with G-E Watch Dog no-blink starters.

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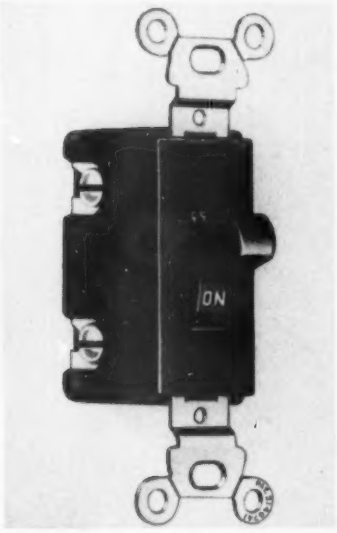
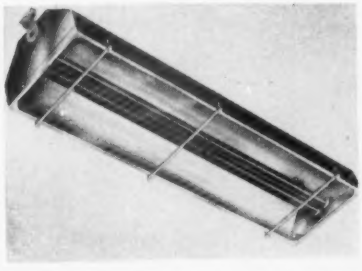
Product News



General Purpose Switch (1)

A new 15-ampere, 277-volt general purpose ac snap switch has been developed to conform with the recently-established Underwriters' standard covering requirements of a general purpose switch for alternating currents only. Switches complying with this standard are suitable for use with a tungsten filament lamp load up to the current rating of the switch at 120 volts, an inductive load (transformer, lamp ballast, etc.) up to the rated current of the switch, and a motor load which draws a full-load current of not more than 80 per cent of the switch's current rating. The switch provides positive closure of the contacts on make, relatively slow separation on break, silver contacts, positive handle ON-OFF indication, and quiet operation.

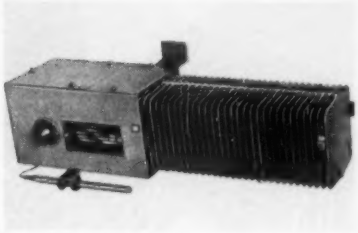
Bryant Electric Co., 1421 State St. Bridgeport 2, Conn.



Backlight Lamps (2)

A new line of improved Blak-Ray (blacklight) lamps designed for use in difficult inspection procedures, in flaw detection, control, processing, invisible marking, coding and other manufacturing operations, as well as for agricultural product examination and inspection. The fact that over 3000 substances are activated by invisible ultra-violet blacklight so that they glow or fluoresce in different shades and colors is the basis for this new method, known as "fluorescent inspection". These substances may be "naturally" fluorescent such as soils, mould, and other types of contamination, or they may take the form of tracer powders, pastes, lacquers, and other substances to be integrated with present materials in varying proportions. Blak-Ray lamps burn cool, start and restart with no warm-up or cooling-off period required, and replaceable tubes last 3000-6000 hours. Units range in size from 4 to 120 watts. Bulletin available.

Ultra-Violet Products, Inc., 145 Pasadena Ave., South Pasadena, Calif.



Electric Heater (3)

Electric heater specifically engineered for pump house. It has a completely sealed-in, cast-aluminum heating element. It has Underwriters' Laboratories approval. The built-in thermostat may be set for temperature desired and operation is entirely automatic. Wall brackets are provided to mount heater on wall. To install, run two wires (120 volt or 240 volt as required) to heater connection box. In addition to pump houses, heater is ideal for use in valve pits, washrooms and warehouses. Literature available.

Electromode Corp., Rochester 3, N. Y.

Room Air Conditioner (4)

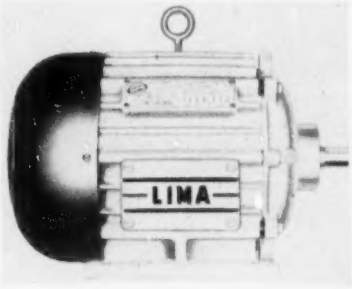
New line of room air conditioners includes ⅓-, ½-, ¾- and 1-hp window units and 1- and 1½-hp console models. The ½-hp deluxe model features automatic temperature control, 2-speed fans, optional electric heating and odor control. The ⅓- and ½-hp units are designed with one-piece tubular housing to permit almost complete installation inside or outside room for compliance with zoning laws. Electric heating is optional on all but the ⅓-hp model and is standard equipment on the 1½-hp console.

Remington Corp., Air Conditioning Div., Auburn, New York.

Truck Body (5)

Designed for telephone, power and light companies, as well as for other utility service, this line construction body is available in lengths from 8 to 13 feet overall, for single or dual-wheel chassis rated from ½ ton to 2 tons, with CA dimensions from 47-in. to 102-in. Designed specifically to mount a winch and derrick, the body is fitted with a sliding roof. Other interior features include a window at front and three deep-lipped stowage shelves running all around. On outside, body is equipped with ladder hooks, hand grips, and three or more large compartments on either side, arranged for tool and parts storage. Each compartment is fitted with tumbler-type lock. The ½- and ¾-ton models have 14 gauge steel front and rear panels, 16 gauge side panels, and 19 gauge doors.

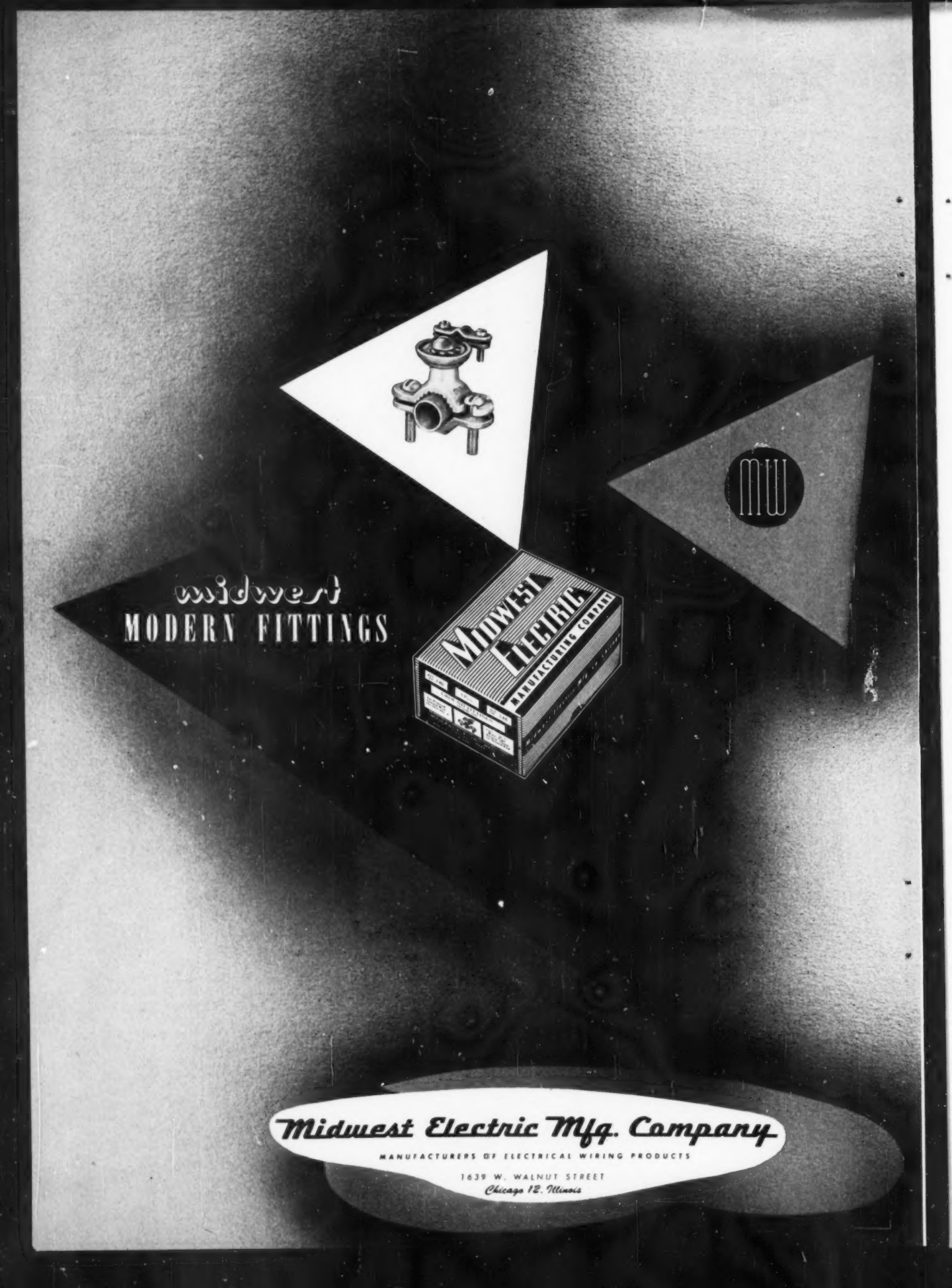
Morysville Body Works, 813 South Reading Ave., Boyertown, Pa.



Motor (6)

A new design of totally enclosed, fan-cooled motor. Type E is available in ratings of ¾ hp at 900 rpm to 20 hp at 3600 rpm in NEMA frame sizes 224 to 325 inclusive. Features include: rigid, cast iron frames with integral feet. Deep, integrally cast fins. Double-width prelubricated sealed ball bearings. Specially designed cast aluminum fan. Electrical characteristics: 2 or 3 phase, all standard frequencies, and commercial voltages below 600 volts, as required. Motors can be supplied for vertical, wall or ceiling mounting, as well as standard horizontal floor mounting. Brochure available.

Lima Electric Motor Co., Lima, Ohio.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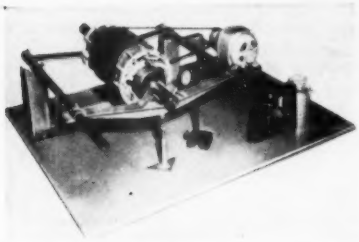

Balancing Machine (7)

Designed primarily for the motor shop industry, the new "Plane-Lock" balancing machine utilizes the basic principles of harmonics for precision balancing of rotors, impellers, armatures, blowers, fans and other such rotating devices. With this new machine, any plane of motion can be locked (reserving it for future balance weights), while leaving another so free to oscillate that the slightest out-of-balance condition can be readily detected for simple correction. The machine has a frame, freely movable and sensitive to the smallest of forces, suspended with a spring of definite resonant frequency. With a rotor under test mounted on the frame and driven at the resonant frequency of the spring, deflection of the frame due to even the least unbalance is indicated on a dial. The machine is available in three models: Model 1 for rotors up to 1 hp, Model 2 for rotors up to 75 hp, and Model 3 for rotors up to 500 hp.

Brownell Distributors, Inc., 306 Canal Street, New York 13, N. Y.

Trouble Lamp (8)

Lightweight explosion-proof trouble lamp for use at hazardous locations. The new Type EPLH lamp is especially practical for inspecting the interior areas of oil and gasoline drums or process vessels and tanks, as well as for illuminating inaccessible gages. Unit consists of a cast aluminum cylindrical-shaped lamp chamber, concentrating lens, composition handle, support hook and explosion-proof cord connector with mechanical cord grip. If one or more explosions take place in lamp compartment caused by an arc in lamp socket, flame-tight threaded joints located around lens housing and along top and bottom sections of lamp compartment confine explosion flames to an area within lamp compartment. A strong beam of light is supplied by a 12-volt auto lamp. An essential accessory for supplying current is an explosion-proof 120/12-volt transformer.

Crouse-Hinds Company Wolf and Seventh North Streets, Syracuse, N. Y.

Insulation Tester (9)

A new high-voltage dc insulation tester for use in maintaining electrical apparatus. Unit is portable. Utilizing dc leakage current principle for non-destructive testing, tester operates on a 115-volt, 60-cycle supply to provide adjustable dc test voltages from 1 to 15 kv. It measures dc insulation resistances up to 30,000 megohms. Tester has a microammeter for measuring dc leakage current through insulation being tested, and a meter for indicating voltage across the insulation. Two current ranges, 0 to 50 and 0 to 1000 microamperes, are provided. A calibration curve of dc resistance in megohms vs. dc leakage current in microamperes at 15 kv is mounted on instrument panel.

Line Material Co., Milwaukee 1, Wis.

Dairy Barn Fans (10)

An improved line of dairy barn ventilating equipment. The line, which includes shutter-attached fans, belt-driven models, and fans with separate shutters, features the use of Westinghouse totally enclosed. Thermoguard-protected motors. Thermoguard feature helps end barn fire hazards and motor burnouts if blade should not rotate due to freezing. Motor stops as soon as it overheats and will not start again until it cools to a safe temperature. This starting and stopping action continues until blade is freed. Fans are also designed for use with a thermostat so that barn temperature can be kept constant automatically regardless of temperature changes during day or night. Models available in sizes from 12 inches to 58 inches in one and two speeds.

Berns Mfg. Corp., 3050 N. Rockwell St., Chicago 18, Ill.

High Bay Lighting Unit (11)

Highbay reflector-housing is designed for use with the new "R" type high wattage incandescent and mercury vapor lamps. They are recommended for lighting dusty, smoky plant areas where high-bay mounting makes lamp cleaning difficult, such as foundries, steel mills, railroad shops, chemical plants, airplane hangars, etc. Recommended where mounting height is ... feet or more. Reflector-housing is constructed of aluminum, finished by Alzak process after forming. Socket housing is an aluminum alloy die casting tapped for ½-in. standard pipe. Unit is ventilated between reflector and socket housing to permit a flow of air. Listed by Underwriters' Laboratories, Inc. It uses 400-watt mercury vapor or 500- to 750-watt incandescent "R" lamps.

Curtis Lighting, Inc., 6135 West 65th St., Chicago 38, Ill.

Control (12)

A new control device, based on the photoelectric principle, for sensitive control of series or multiple outdoor lighting circuits. Control is built around a dip-soldered etched circuit. Built-in lightning protection is provided. Low level illumination is offered with Types P-1 and P-1A for street lighting circuits. High level illumination is handled with Types P-2 and P-2A for airport and sign lighting applications. A Type P-1 unit is converted to a Type P-2 by the addition of a phototube shield. Control is adjustable to operate under any conditions at a light level from 1 to 6 or 10 to 60 foot-candles at the "sky view" of the phototube. The control is available in either 575 or 3500 watts load capacity.

General Electric Co., Schenectady 5, N. Y.

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Count on being really satisfied with Klein-Kord *nylon* Safety Straps. They're smooth and flexible, require no special care—and give you that important extra margin of safety. Made of multiple plies of strong, finely woven *nylon*, bonded together with frictioning and vulcanized in neoprene. Red center is a safety signal to "Stop When You See Red!" Equipped with finest drop-forged hardware.

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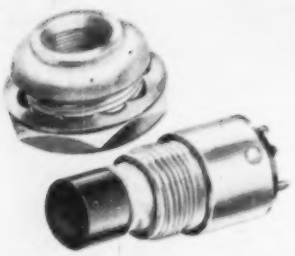


Switches (13)

Moistureproofed, momentary-contact pushbutton switches designed to meet Mil-S-6743 specifications. Known as Series W100, these small snap-action switches are suited for aviation and critical industrial applications where long life and positive action are essential. Switches may be ordered with a variety of adapters to meet practically all front-of-panel, back-of-panel, edge-lit panel, blind hole, or force-fit mounting requirements. Available types include SP-ST, 3-terminal, or SP-DT circuit arrangements. Current ratings are 10 amps resistive, 5 amps inductive, and 3 amps lamp. Switches measure 1⅞ in. long. When used with an adapter, they mount in a ⅝-in. diameter panel hole. Bulletin available.

Hetherington, Inc., Sharon Hill, Pa.

Fluorescent Luminaires (14)

The new 6000 series industrial lighting units are designed to eliminate "tunnel lighting". They are engineered to direct 25% of light output upwards and 75% directly to work area. Crosswise shielding of 35° is provided for direct component. Where 25° lengthwise shielding is desired, louvered units are available. This series of semi-direct fluorescent units are for use with 4-ft, 5-ft, and 8-ft lamps. Available with Alzak aluminum, porcelain enamel or baked white "Fluracite" enamel steel reflectors.

Curtis Lighting, Inc., 6135 *West 65th St., Chicago* 38, *Ill.*

Combination Dial (15)

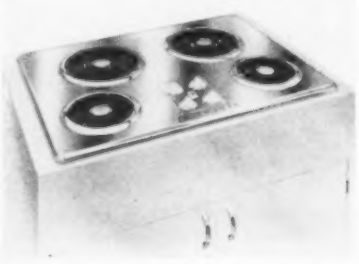
The new Tork dial makes it possible for automatic time-switches to control both long and short operations with the use of one dial. The combination dial consists of a 24-hour dial mounted on a 60-minute dial. Pin settings permit the automatic control of operations from 1 to 55 minutes at every or any hour of the day. The new dial will be standard equipment on many Tork units now in production, and may also be used to replace standard 24-hour dials on certain of the older standard units.

Tork Clock Company, Inc., Mt. Vernon, N. Y.

Powder-Actuated Tool (16)

The Drive-It model "410" is a heavy-duty tool which uses specially loaded .38 caliber blank cartridges to drive hardened steel pins (with ¼ in. and ⅛-in. thread or head diameter) into concrete or steel. It drives 8 studs a minute. The "410" pivots open at breech for fast loading and has automatic cartridge ejection. Other features are a "Stripping Lock" by which tool can be disassembled for cleaning "Anti-Recoil" safety pad that keeps tool on work surface; positive two-handed operation. The automatic extension barrel allows fastening in recesses where safety pad will not fit. "Pistol grip" handle and forepiece are of Neoprene.

Powder Power Tool Corp., 7526 S. W. Macadam, Portland 1, *Ore.*



Cooking Tops (17)

Two new-model cooking tops have been added to the Bilt-in Electric Range line. The tops, identical sizes of 30 in. long by 21¾ in. wide, are designed specifically for maximum facilities within limited areas. These stainless steel tops are available with two arrangements: SU-4C with three speedy Thermo-Kleen surface units and deep-well cooker; and SU-4D, four-surface units.

Thermador Electrical Mfg. Co., Los Angeles 22, Calif.

seasons greetings

Symbolized by the open door, Leviton expresses its gratitude to customers, friends, and suppliers—all of whom have helped make possible the ceaseless improvement of Leviton wiring devices and the steady growth of Leviton's facilities and services.

It is always good to greet a friend — and at this season of reflection and good will we wish the best to all our friends for all the coming year.

LEVITON MANUFACTURING COMPANY

BROOKLYN 22, NEW YORK • CHICAGO • LOS ANGELES • AMERICAN INSULATED WIRE CORP. • PAWTUCKET, RHODE ISLAND

LEVITON

NEW BULLETIN helps you plan outdoor circuit protection

Just off the press, here is a handy reference to the complete line of Heinemann Outdoor Service Equipment. It explains in detail each classification of available equipment . . . service entrance, receptacle-type, dual control, three-phase units . . . tells you how to use them in particular applications.

Typical assemblies of circuit breakers and the various enclosures are listed for each type of equipment. To guide you further in the selection of enclosures to match your needs exactly, a comprehensive table of the entire Outdoor Service Equipment line is included. At a glance, it tells you catalog numbers, hub sizes, voltage and ampere ratings and other specifications.

The hydraulic-magnetic operating principle of Heinemann Circuit Breakers is explained, and concisely told are the reasons why application of this principle can lead to reduced costs and greater sales potential for the rural utility, greater protection and better service for the user.

This new bulletin is your first step in planning better outdoor circuit protection. It's yours without obligation.

Write now for your copy of Bulletin 2016.

HEINEMANN ELECTRIC CO.

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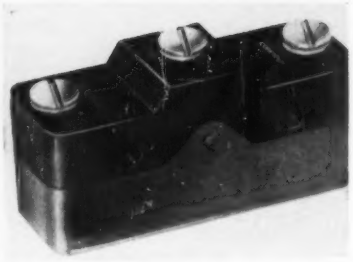


Electric Switches (18)

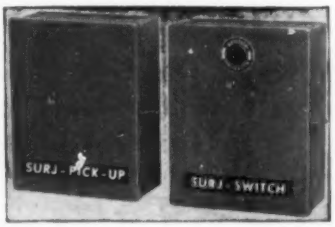
Electrical connections are simplified by the new base design now available in Unimax snap-acting switches. Base provides terminals sturdy enough to suit wiring practices for circuits handling the 17 amperes at which these switches are listed by Underwriters' Laboratories, Inc. Terminals are uniformly spaced along switch base, on which a central step lengthens creep distances so that no insulating barriers are required and circuit separation is maintained. Flat surfaces and 6-32 binding-head screws of terminals allow connection by standard-size lugs or looped wires up to No. 14. Base carries markings that identify the normally-open, normally-closed, and common contacts. Data sheets available.

Unimax Switch Div., W. L. Maxson Corp., 460 W. 34th St., New York City

Lag Screw Shields (19)

Hi "Super-Cast" lag screw shields are made in four sizes—¼ in. to ½ in.—short and long. They are precision cast. Rings on outside are designed to give maximum holding power and re-enforced. Shields are made of a special rust-resisting alloy. Also included in the line are ⅜-in. and ½-in. shields made of malleable iron.

Holub Industries, Inc., Sycamore, Ill.



Control (20)

Switch operated by current surge is used for actuating electric counters, protecting dies, motors and machines, indicating work stoppage. Known as the Surj-Switch, the control is connected into one side or one phase of power circuit. Current surges produced by work operate

a relay. When no work surge occurs, relay does not operate. Through use for built-in timers and/or auxiliary switches, interfering surges can be weeded out. In timer-equipped models, both Surj-Switch and timer have relays: either or both relays may be used for control functions. A complete unit includes a Surj-Pickup and a Surj-Switch, independently housed in identical cabinets 10⅛ in. high, 8¾ in. wide and 4½ in. deep. Surj-Pickup may be used with power circuit ranging from 0 to 80 amperes, any voltage, 50-60 cycles, ac. Surj-Switch can be furnished for either 115 or 230 volts, 50-60 cycles, ac. Both Surj-Relay and timer relay contacts are rated at 5 amperes, 115 volt, ac, non-inductive load. Timers are adjustable for any timing period from 1 to 15 seconds. Literature available.

Autotron Company, Danville, Ill.

Adapter (21)

Newly designed and completely interchangeable with all other makes is Catalogue No. 1032, a 2-wire to 3-wire polarized adapter. Ideally suited for conversion of a 2-wire system to a 3-wire polarized grounding system, adapter is also available with a 3-inch lead 1032L. Up to an 8-inch lead on 1032L will be supplied upon request. The third blade is grounded by means of a binding post at side of body. It features double-wiping contacts, self-finding slots for extra safety factors, and a bakelite construction. It is rated 10 amps, 250 volts and 15 amps, 125 volts.

Rodale Manufacturing Co. Inc., Emmaus, Pa.

Room Air Conditioners (22)

Redesigned line of room air conditioners, including ⅓, ½, ¾ and 1 hp models. The three larger-capacity conditioners are alike in appearance, have all-steel cabinets finished in mahogany-grain coat of baked enamel with gold-finished ornamental grille. ¾-hp model will be available with reverse cycle operation for heating in cool weather, operates on either 115-, 208- or 230-volt circuits. 1-hp model is available for 208- or 230-volt operation, while ½- and ⅓-hp models operate on 115 volts.

General Electric Co., 310 W. Liberty St., Louisville, Ky.

Permanent Efficiency!

SILVERED-MIRRORED PERMAFLECTORS

UP TO DOUBLE the footcandles with standard lamps! That's the performance record of silver-mirrored Permaflectors. This amazing efficiency more than pays for the equipment cost in a short time . . . and continues to pay dividends in lower operating costs. Whatever the wattage, or the job—a Permaflector does it best!

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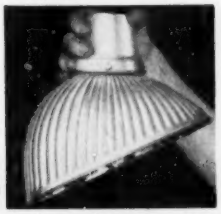

4 A final silver-gray, satin finish gives added protection, blends with all interiors.

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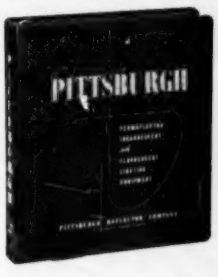

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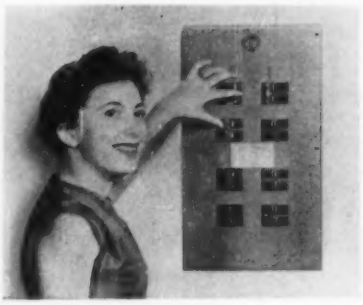
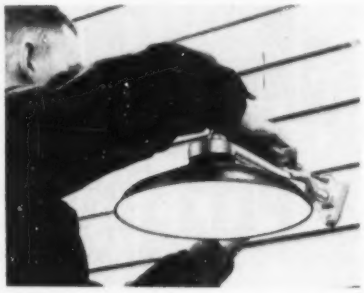


Load Center (23)

A new 16-circuit split-bus Trumbullite load center uses quick-make, quick-break circuit breakers which are arranged within the enclosure in two groups, or blocks. Interiors are mounted on captive springs. Free-floating design makes it possible to square up interiors and face plate with wall surfaces, even though enclosures may be mounted out of line. Bus bars and stabs are silver-plated copper for positive conductivity. Pressure contacts on circuit breakers are used to engage bus bars securely. Bus bars are mounted on phenolic supports, while heavy duty silver-plated solderless lugs are provided for line connections.

Trumbull Components Department, General Electric Co., Plainville, Conn.



Lamp Reflector (24)

A new type of Yardlite lamp reflector which meets a wide variety of outdoor applications. It mounts on vertical surfaces and is supplied complete with reflector, socket, socketholder, pipe bracket, wall fittings and insulators. Any standard lamp can be used. Two reflector sizes are available: 12-in. diameter reflector for 60- to 100-watt lamps and 14-in. diameter reflector for 150-watt lamps. Two finishes on outside are available—Lifetime porcelain enamel or Permagloss baked enamel.

Abolite Lighting Division, Jones Metal Products Co., West Lafayette, Ohio

Controls (25)

A new line of composition-element and wire-wound controls designed specifically for industrial, laboratory, and other semi-critical applications. Designated as the "C-line" controls, they are of the factory-assembled, fixed-shaft type. Available with either a $1\frac{3}{8}$-in. round, nickel plated shaft, or a $\frac{1}{4}$-in. screwdriver slot-type shaft with split locking bushing. Series 37C1 and 37C2 composition element controls are rated 1 watt. Resistance range is from 500 ohms to 10 megohms. Series 43C1 and 43C2 wirewound controls are rated at 2 watts. Resistance range is from 5 ohms to 10,000 ohms. Series 58C1 and 58C2 wire-wound controls are rated 3 watts. Resistance range is from 1 ohm to 50,000 ohms. Series 10C1 and 10C2 wire-wound controls are rated 4 watts. Resistance is 75,000 and 100,000 ohms. C1 designation indicates a $1\frac{3}{8}$-in. round shafe beyond bushing, $\frac{3}{8}$-in. long bushing with $\frac{1}{4}$-32 NFF-2 thread. C2 is a $\frac{1}{4}$-in. screwdriver slotted shaft with a $\frac{1}{2}$-in. split locking bushing.

Clarostat Mfg. Co., Inc., Dover, N. H.

Emergency Light (26)

New Light Chargomatic 88 furnishes instant, automatic emergency light whenever regular source of power fails. It plugs into any 110-v. ac outlet. Features of unit are complete automatic charging; a 6 volt, 105 ampere-hour glass jar battery with visible balls; increased capacity. Light Warden is equipped with two chrome-plated adjustable sealed beam flood heads which will furnish emergency lighting protection for approximately 12 hours. It will take up to five heads which can be placed wherever needed.

Electric Cord Company, 195 William St., New York 38, N. Y.

Winch (27)

The new Giline winch is designed to simplify, and make more efficient methods of securing guy lines. Designed for one bolt mounting. Channel ratchets are made of 12 gauge steel, with drums of heavy steel rods. Electroplate finish over all. Cotter pin locks firmly in place against ratchet pawl. A turn of wrench gives proper tension on guy lines.

Royal Television Supply Co., Modesto, Calif.

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Wallbox Dimmer

- Any amount of light from darkness to full brightness
- Installed as easily as the ordinary wallswitch
- Economical, cool, silent operation
- Approved by the Underwriters' Laboratories

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Controlled Light

The modern era of home lighting is at your fingertips. Gone is the "on-off" lighting of the ordinary wallswitch. A new concept in light control, the **powerstat** Wallbox Dimmer, replaces the wallswitch to permit the control of light from complete darkness to full brightness. Simply turning a knob brightens or softens light silently and smoothly — selects the amount of light just right for any occasion or activity — for the reflection of every mood — the ideal brightness for every seeing task.

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Complete information about Controlled Light is available in Bulletin D653WBT. And for your customers, a simple, non-technical Bulletin D253WBC

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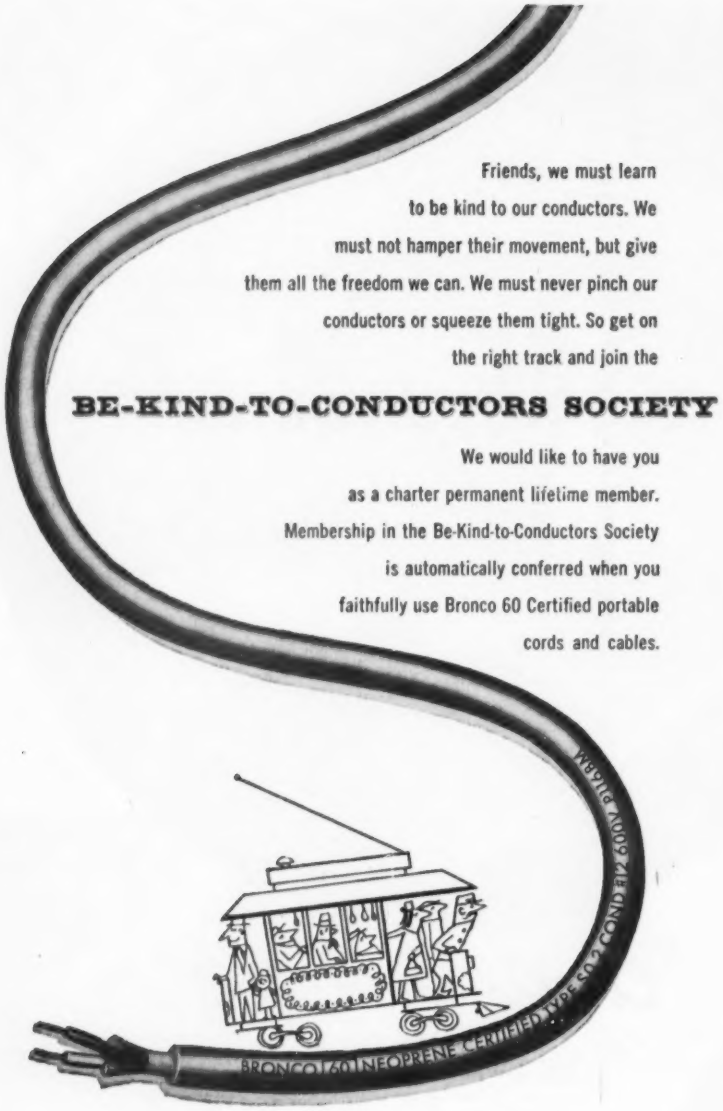

Friends, we must learn to be kind to our conductors. We must not hamper their movement, but give them all the freedom we can. We must never pinch our conductors or squeeze them tight. So get on the right track and join the

BE-KIND-TO-CONDUCTORS SOCIETY

We would like to have you as a charter permanent lifetime member. Membership in the Be-Kind-to-Conductors Society is automatically conferred when you faithfully use Bronco 60 Certified portable cords and cables.

Never before were conductors given such staunch and loving care. A 60% by weight Neoprene jacket wards off oil, acids, sunlight, ozone, and such. When the whole shebang is joined together, vulcanization is carried through in a civilized manner that does not squeeze, bind, or hamper the conductors.

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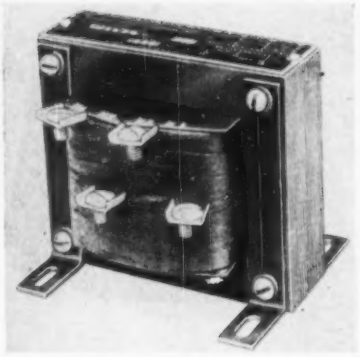
gives all the protection a conductor could ask for.

Would you like a free button and membership card? Just tear off the end of a BRONCO reel or carton and mail it together with a streetcar token or valid transfer to cover cost of handling to

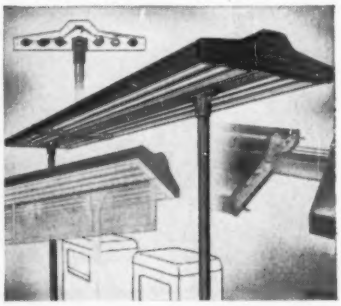
WESTERN INSULATED WIRE CO.
Los Angeles 58, California
(BE SURE TO PRINT YOUR NAME AND ADDRESS)



Control Transformers (28)

New line of machine tool control transformers designed to provide regulations that permit for maximum performance of electrical components. The line has been engineered so as to supply maximum momentary current demand with a minimum of voltage drop. Other features are rugged construction, use of silicon steel, annealed laminations, vacuum impregnated coils, hand finished taps and permanently anchored screw terminals. Mounting centers are jig set to assure interchangeability. Transformers have wide usage not only in machine tool field, but wherever there are control problems on equipment designed for 230 or higher voltage operation.

Acme Electric Corporation, Cuba, New York.

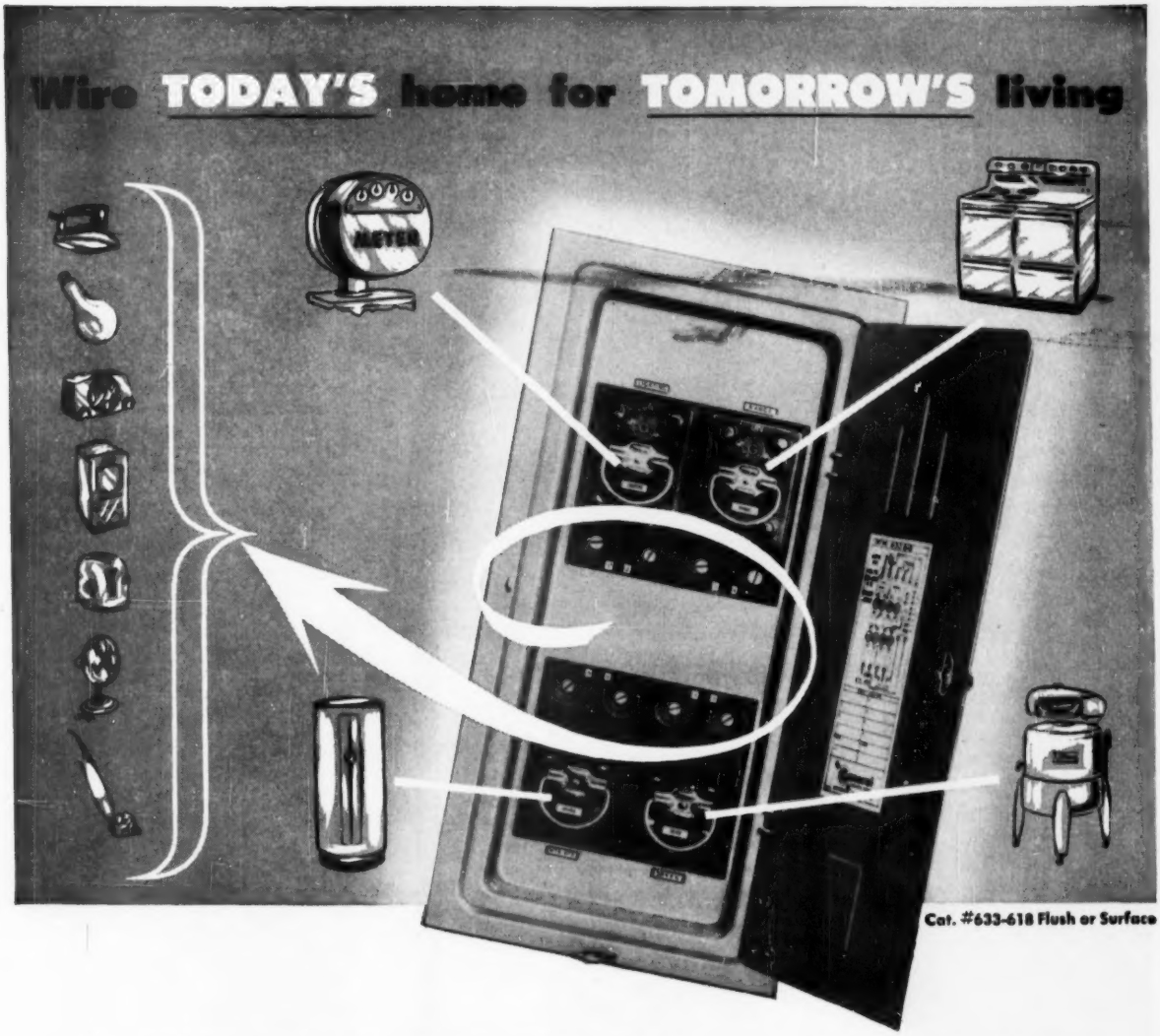


Lighting Unit (29)

A new fluorescent "T" lighting unit, called "Teelon", can be fitted to any pump island. "Sliding" construction makes it possible to adjust unit to any pole spacing. Units are available in 4-ft. and 8-ft. sections which can be combined into units as long as 16 feet. Only one pole is needed for 4-ft. to 8-ft. lengths; two poles for lengths over 8 ft. and up to 16 ft. It uses metal-clad "Springlox" lampholder. It has one-piece, weatherproof housing and is available in either porcelain enamel or baked synthetic enamel finish. All wiring is enclosed and accessible by removing interior reflector plates. Sections are available for 4 or 6, single-pin, 48-in. or 96-in. T12 slimline lamps. Units are available in a choice of six colors.

Benjamin Electric Mfg. Co., Des Plaines, Ill.

Wire TODAY'S home for TOMORROW'S living



Cat. #633-618 Flush or Surface

General brings you a "Main and Range Plus"! The *quadruple* pullout unit that actually plans for the future. Not only does this all-in-one unit take care of today's wiring requirements . . . it *anticipates* tomorrow's needs. Eliminates costly auxiliary wiring equipment, and unsightly additions. The General Quadruple Pullout unit is neat, compact, thoroughly dependable. It saves you time and materials . . . at a price you want to pay. No wonder wholesalers and contractors all over the country are saying: Switch to General today! Available everywhere exclusively through wholesalers.

100 Amp. main lugs feed 4 pullouts connected in parallel. One 60 Amp. functions as a main disconnect for eight 30 Amp. plug-fuse branch circuits and the 60 Amp. sub-feed lugs. Three additional pullouts (one 60 Amp. and two 30 Amp.) control appliances such as, Ranges, Water Heaters, Dryers, etc. Other combinations may be ordered.

Sales Offices in every Major City

General Switch Corp.

Write for catalog #5201

45 ROEBLING ST. • BROOKLYN 11, N. Y.

ENCLOSED SAFETY SWITCHES • SERVICE ENTRANCE EQUIPMENT • BRANCH CIRCUIT PANELS

FULLMAN **Latrobe**
Electrical Products

Floor Boxes and Wiring Specialties

ADJUSTABLE WATERTIGHT FLOOR BOXES

NON-ADJUSTABLE WATERTIGHT FLOOR BOXES

ADJUSTABLE GANG FLOOR BOXES 1-2-3 AND 4

NOZZLES AND FLOOR BOX ACCESSORIES

FLOOR JUNCTION BOXES

UTILITY OUTLETS

INSULATOR SUPPORTS

PIPE AND CONDUIT HANGERS

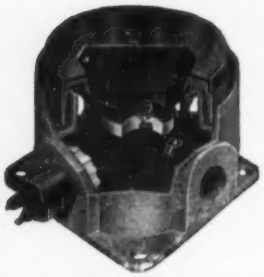
ARMORED CABLE SUPPORTS

CABLE CLIPS

STAPLES

FISH WIRE

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE OF SUPREMACY LATROBE, PA.



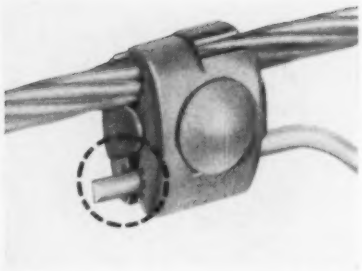
Adjustable Watertight FLOOR BOXES

Latrobe Adjustable Floor Boxes are completely fire-proof and comply with the National Electrical Code. Come in single round or square bodies—also in square type Two, Three and Four gang types. Gang Box Bodies are provided with solid partitions to separate low and high tension wires.

PIPE OR CONDUIT HANGER

Most economical and best pipe hanger sold today. The saddle comes firmly fastened to the hanger bracket and cannot drop out. Made of highest grade malleable iron and has case-hardened, cup point set screw.

Fullman Manufacturing Co.
1209-1215 JEFFERSON STREET
LATROBE, PA.



Clamp (30)

A new, improved design for the aluminum-copper parallel groove clamp. Design incorporates a recently developed process of manufacture which eliminates the use of solder in attaching the copper line or the cast aluminum body. By using this process no moisture trapping voids or fluxes can develop between liner and body to foster galvanic corrosion. Aluminum body is pressure cast around pronged copper liner. This airtight shrink fit permanently seals out moisture. Special surface treatment of underside of copper liner reduces surface tension of molten aluminum. Aluminum body is cast of a special alloy. One clamp covers a wide range of popular conductor sizes.

Jasper Blackburn Corporation, 35 Madison St., St. Louis 6, Mo.

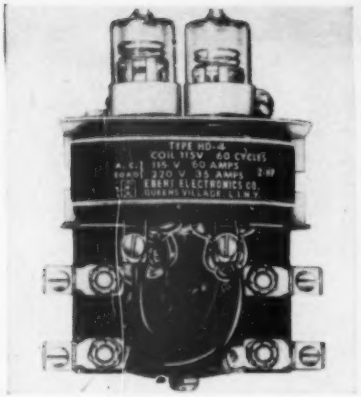
Lighting Unit (31)

A weatherproof low-wattage lighting unit, the PL-5, for use as a warning light, signal light, or marker light. Unit employs 7C7 lamp through a Fresnel lens which gives a bright continuous light pattern in a 180° arc. It is furnished in two mounting types, either for ½-in. pipe mounting from back or bottom of unit, or for FS box mounting. Suggested industrial uses are on control panels, machinery, and to mark hazardous areas. Unit may be supplied with blue, green, red, orange, yellow, white or clear lamps.

Spero Electric Corp., 14838 Euclid Ave., Cleveland 12, Ohio.

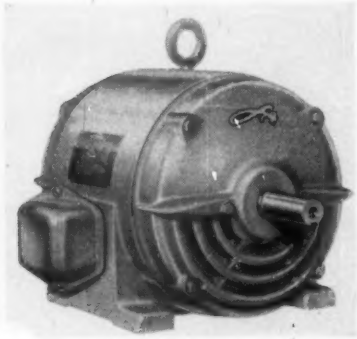
Contactor (32)

Mercury contactor HD-4 for all heavy-duty control applications. It features mercury-to-mercury contacts. It is silent, chatter-free, hermetically-sealed, explosion-proof and requires no maintenance. The overall dimensions are 5 in.



by 3⅜ by 2½ in. HD-4 is a two-tube contactor. Each tube will control 60 amperes at 115 volts ac and 35 amperes at 230 volts ac. For dc. control capability per tube is 12 amperes at 115 volts. For motor control, the HD-4 is rated at 2 hp at 115 volts ac (single phase), 3 hp at 230/440 volts ac (single phase) and ½ hp at 120/220 volts dc. Coils are available for a variety of control voltages. It can be obtained with both tubes normally open or both tubes normally closed. For special applications, such as in standby power or switching, it is available with one tube normally open and one tube normally closed.

Ebert Electronics Co., 212-26 Jamaica Ave., Queens Village 28, L. I., N. Y.



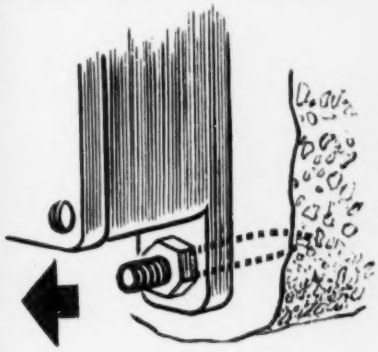
Redesigned Motor Line (33)

A completely redesigned line of alternating current motors up to NEMA frame size 326 (40 hp open type; 25 hp totally-enclosed, fan-cooled type, 3600 rpm) meeting new NEMA standards of frame size and increased horsepower ratings. Added to the new streamlined styling are the following features: weight reduction; improved shaft and bearing design (using standard stock bearings); better ventilation; split conduit box design for easier connection; permanent lead identification spacer in conduit box; improved drip-proof features; longer stator housings and more shallow end-bells for coil-end protection. Motors have removable plug in front-end bearings to permit speed checking; also more versatile mounting features. Units in smaller frame sizes will be available in January, 1954.

The Louis-Allis Company, 427 E. Stewart Street, Milwaukee 7, Wisconsin.

SPEED ELECTRICAL WORK

DRIVE-IT 320
WITH
BREAK-OPEN ACTION



SPLIT-SECOND FASTENING TO CONCRETE OR STEEL

These explosion proof switch boxes were anchored to the concrete blocks with *DRIVE-IT* powder-operated fastening system. Hardened steel drivepins are accurately driven into concrete or steel with savings in time, money, and material. Fasten junction boxes, control panels, bus bars, conduit clamps, motors and many other items with *DRIVE-IT*.

NEW DRIVE-IT 320 FEATURES BREAK-OPEN ACTION FOR FAST, EASY LOADING AND EXTRACTION. OTHER JOB-PROVED DRIVE-IT FEATURES ARE:

ONE POWER LOAD. Variable penetration with one strength power load.

AUTOMATIC EXTENSION BARREL. Integral with tool. Extends to fasten in recesses.

SWIVEL SAFETY PAD. Swivels 360° to fasten near adjoining surface. Steel and tough Neoprene for protection.

SAFE TWO-HAND FIRING. Tool must be held against work to operate. Two-motion firing action for safety.

LOW COST DRIVEPINS. Prices are lower on wide range of drivepins.

FOR MORE INFORMATION

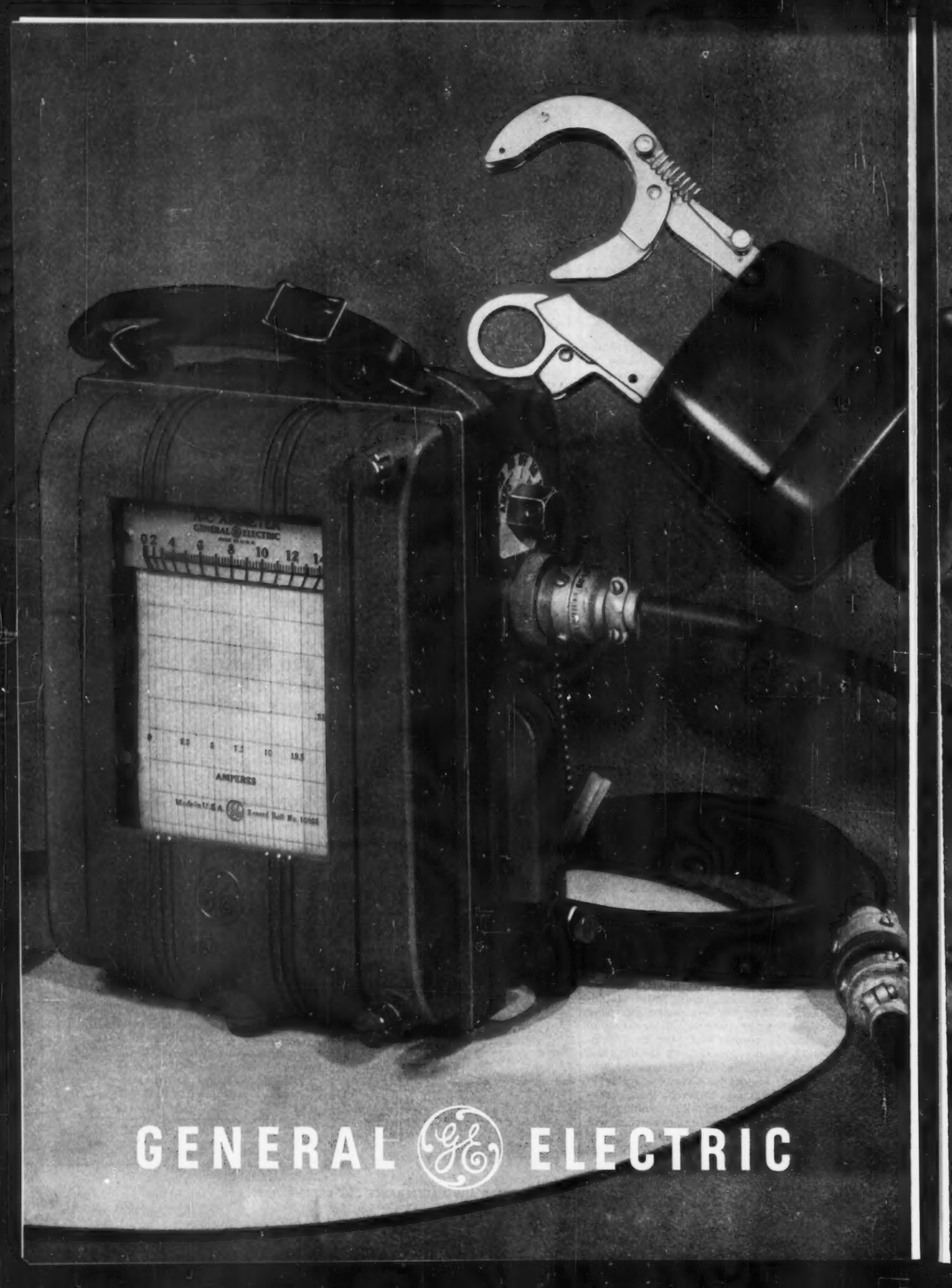
DRIVE-IT
the original
POWDER-ACTUATED TOOL

MAIL THIS COUPON

POWDER POWER TOOL CORP.
7526 S. W. Macadam Ave., Dept. F
Portland 1, Oregon

☐ Please send literature on DRIVE-IT "320"
☐ I'd like a demonstration of DRIVE-IT "320"

Name_____
Address_____
City_____ State_____


GENERAL ELECTRIC
AMPERES
GENERAL ELECTRIC

COMPLETELY NEW—

G-E Hook-on Recorder

Here is a brand new solution to one of your old electrical-testing problems. General Electric's new CF-7 portable hook-on recorder (volt-ammeter) gives you the first convenient means of recording current without having to cut conductors or interrupt service.

By simply attaching leads, you can get voltage records over a wide range. The CF-7's butyl-molded transformer is insulated for 8700 volts.

FAST HOOK-ON INSTALLATION

You can install the CF-7 in little more time than it takes to use any hook-on instrument. Simply mount the recorder, select a range, attach leads, and hook on. Simplicity makes the CF-7 ideal for on-the-spot checking of loads on motors, circuits, and transformers.

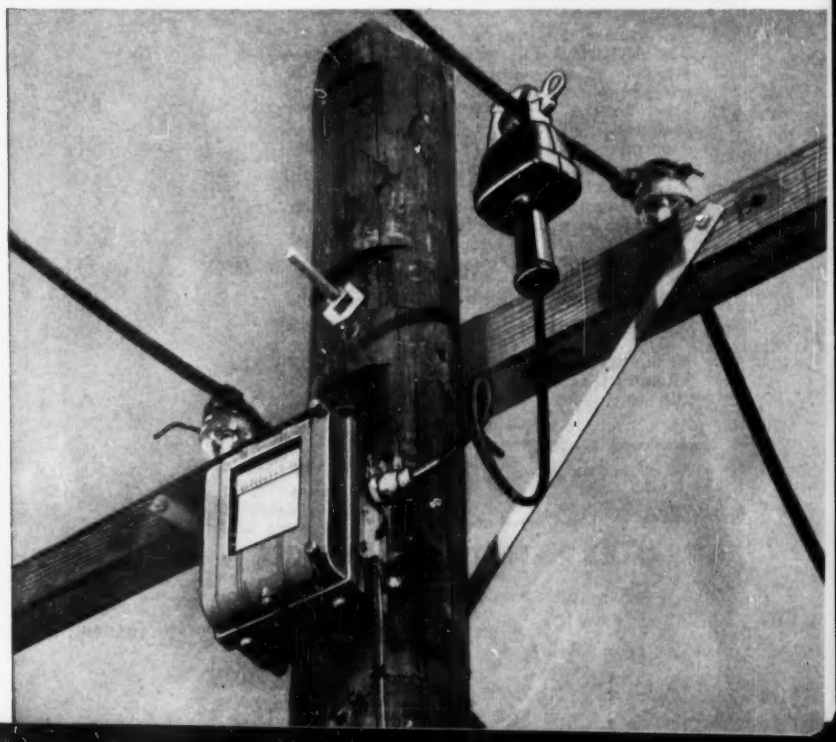
MINIMUM SERVICING

Consisting of a hook-on current transformer, connecting lead, and inkless recorder, this new instrument offers you:

- Inkless recording for minimum servicing, clean records;
- Weatherproof construction for outdoor and indoor use;
- Accuracy to 3% of full scale (4% above 625 amperes);
- Seven ranges—15/75/150/750 amperes, 150/300/750 volts.

See the CF-7 hook-on recorder at the Plant Maintenance and REA shows in January. For full details, contact your Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. 602-267

SELF-SUSPENSION of the current transformer is made possible by a spring latch. Self-locking simplifies installation in such applications as checking of line loads.



The ARROFLUTE "Silent Salesman" is now available to all industrial, hardware or electrical suppliers. This new counter or wall display features five ARROFLUTE Carbide Masonry Drills and a pocket space for the descriptive ARROFLUTE literature supplied with the display. Furnished without extra charge with your order for the five drills featured on the display, this "Silent Salesman" is a must on your sales force.

For all masonry drilling . . . specify ARROFLUTE.

Write, asking for full details on the new ARROFLUTE "Silent Salesman" . . . or better still, order your "Silent Salesman" today.

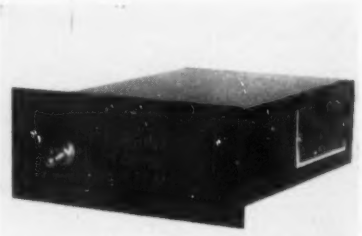
TRADE ARRO MARK

ARRO EXPANSION BOLT CO. • MARION, OHIO
1540 BOONE AVENUE

Lighting Unit (34)

One standardized Unilet body fits both 60- to 200-watt and 300/500-watt dome unit assemblies. These explosion-proof fixtures are known as Vented "AA-51" series and are approved for all hazardous areas in Class 1, Groups C and D. It has the 5-thread safety chamber. Because of interchangeability of dome unit assemblies it is possible to set up a "stand-by" system which takes care of lamp replacement and increased wattage needs. Unit is adaptable to pendant, ceiling, long bracket or short bracket mounting and will take a standard dome, shallow dome, deep bowl, or 30° angle reflector.

Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill.

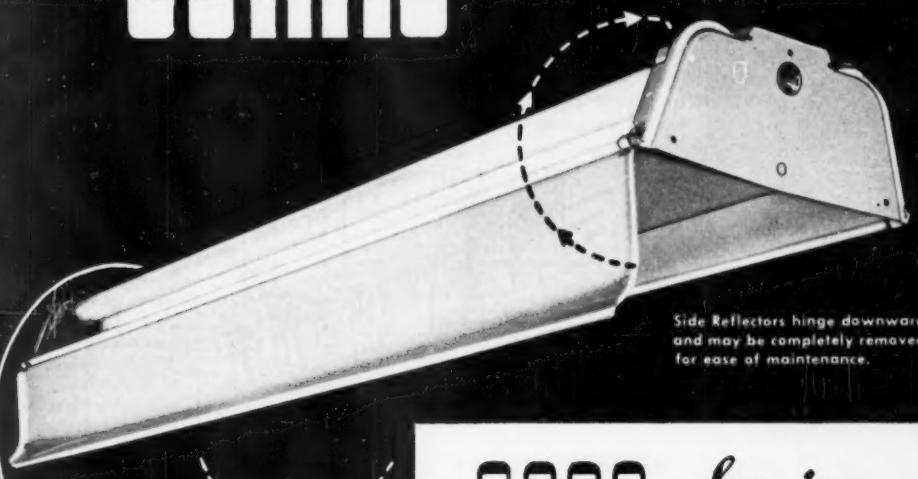


Annunciator (35)

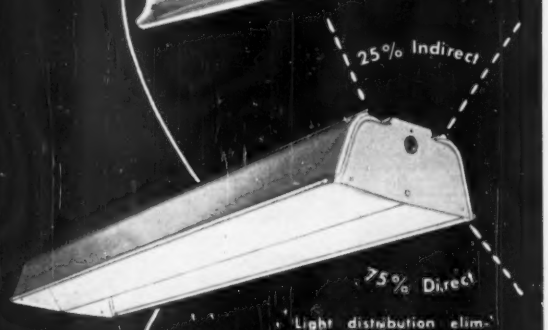
Model MLT panel mounted individual lamp annunciator has a back-lighted illuminated nameplate fastened to front of small metal cabinet. Cabinet contains lamps, relays, switches, etc. and is factory-wired for specified operation. Annunciator unit is installed in a $1\frac{3}{4}$-in. by $4\frac{1}{2}$-inch opening in a panel. Rear of cabinet holds terminal block for connection to supervised "trouble" contact, power, and common audible service. Area of nameplate available for engraved "message", with toggle switch is $2\frac{1}{4}$ in. by 1 in. Unit is also available without toggle switch, Model MLP, providing an area for engraving of 3 in. by 1 in. This unit for use in services requiring a common silencing and/or reset pushbutton. The MLT-200 unit for No. 200 service gives an alarm for abnormal as well as restored contact conditions. Any number of individual units may be connected to a single audible signal device.

H. R. Kirkland Company, Morristown, New Jersey.

the new CURTIS *industrial*



Side Reflectors hinge downward and may be completely removed for ease of maintenance.



Light distribution eliminates severe brightness contrast and tunnel lighting conditions.

Louvers available where greater lengthwise shielding is desired.

Curtis "Tang Hangers*" facilitate and cut installation cost as they allow flexibility in placement of hangers and permit bypassing of building construction obstacles such as beams, sprinkler heads, etc.

*Pat. applied for.

6000 *Series*

The New Curtis "Six Thousand" series is designed for Eye-Comfort® in industrial locations. The Luminaires illuminate the ceiling with an indirect component of 25% of the light output. Crosswise shielding of 35° is provided for the 75% direct component. The lighting units in this versatile line are available with Alzak Aluminum, Porcelain Enamel, or baked white "Fluracite" enameled steel removable side reflectors. Low cost efficient maintenance is provided by having side panels readily removable for cleaning. In addition there are no horizontal diffusing or reflecting surfaces to collect dust. There is a unit in this versatile line to accommodate all 4', 5' and 8' fluorescent lamps. The Curtis "Six-Thousand" series brings Appropriate Brightness Control Lighting to industrial areas. Mail coupon for FREE descriptive literature.

CURTIS LIGHTING, INC.
Dept. L12-20 6135 West 65th Street
Chicago 38, Illinois

Name_____

Company_____

Address_____

City_____ State_____

the Emblem of Quality since 1875

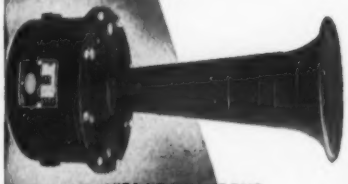
FARADAY

SIGNALS and SYSTEMS

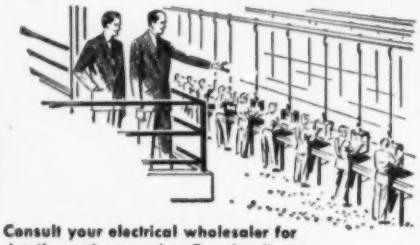
ADD *SPEED . . . SAFETY*

Properly designed and installed signals and systems are real time-savers that smooth out many a plant problem—help stop wasted motion. And solving individual signaling problems has been Faraday's business for *seventy-eight years.* These years of experience assure correct plans, correct installation. To be sure that your signaling system is operating at top efficiency, check with Faraday. No obligation.

NECK-TYPE BELLS



VIBRATING HORNS



Consult your electrical wholesaler for details on the complete Faraday line.

HOLTZER-CABOT **FARADAY** STANLEY & PATTERSON

CONSOLIDATED BY:

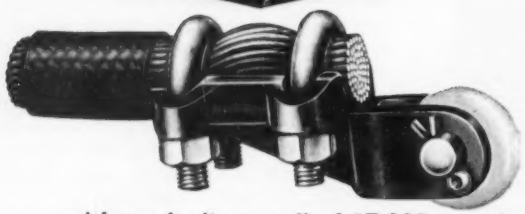
SPERTI FARADAY INC. ADRIAN, MICH.

BELLS · BUZZERS · HORNS · CHIMES · VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS

LOCK CABLE SAFELY, SECURELY *with*—

"EFFICIENCY" Cable Strain Clamps

without Strain or Damage



. . . withstands direct pull of 17,000 pounds

Efficiency Cable Strain Clamps lock cable safely and securely without possible strain or damage. "H" construction of clamps and high ridge across center of cable prevents cable from slipping.

Takes cable from 1/0 to 1,500,000 c.m. Three clamp sizes cover all cable sizes. Furnished with eye or clevis, for AC or DC service.

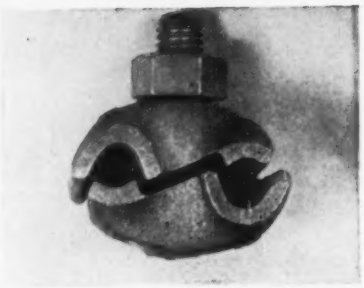
Write for Catalog 38-A

Efficiency ELECTRIC AND MANUFACTURING CO.

MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT, WIRE AND CABLE SUSPENSION

EAST PALESTINE, OHIO

"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION



Connector **(36)**

A new corrosion-resistant, parallel groove connector for electrical transmission and distribution lines can be installed as a unit. New fitting's hex nut is backed up a few turns and the assembly is slipped over the conductors. Then the nut is tightened, locking connector in place. Specially shaped contact faces are claimed to accommodate well over 100 combinations of copper, aluminum or ACSR conductor diameters from No. 6 to 4/0 AWG. The new connector's corrosion-resisting properties result from a silicon-aluminum alloy and a newly developed surface treatment. After assembly is chemically cleaned, it is immediately dried and dip-coated with an oxide-inhibiting seal. The coating on fitting's contact surfaces is automatically removed during installation to provide a high-conductivity joint. Installation instructions are the same for aluminum, copper or ACSR conductor. To promote a high conductivity joint, conductors should be coated with an oxide-inhibitor compound, either a grease base or zinc chromate paste type.

Thomas & Betts Co., Inc., 36 Butler St., Elizabeth, N. J.

Truck Body **(37)**

The new 5,000 WD two man line body, with complete equipment available, performs all line work functions. The body compartment, of all-steel construction, has ample room for necessary tools and materials. Long tools are carried above side compartments; extension ladders mounted on left side do not interfere with use of left cab door. Special compartments accommodate saws, water cask, cup dispenser and rubber goods, while a telescoping roof protects entire interior loading space. Optional equipment adapts the unit for pole setting and digging.

York-Hoover Corp., Body Division, York, Pa.

THE ONE-TWO SPLICE

It saves space in remodeling the Ford Rotunda

When the Jack Frost Electric Co., of Detroit, took over the electrical work in the recent remodeling of the Ford Rotunda, they wanted a splicing method as modern and as streamlined as the building itself.

That's why they chose The One-two Splice. It's made with "Scotchlok"—the world's tightest-gripping spring connector, and insulated with "Scotch" 33—the super-thin plastic tape with 10,000 volt dielectric strength. It's the world's safest, most compact connection.

What makes The One-two Splice so safe? The "Scotchlok" steel spring construction grips the wires *tight*—actually *threads* the wires for extra-strong hold. That's why "Scotchlok" will not shake loose.

What makes The One-two Splice so compact? "Scotch" 33—the thin, tough plastic tape now available in ¾ in. x 20 ft. "Job Size" rolls packed 12 to a screw-top container.

Try The One-two Splice yourself! Order "Scotchlok" and "Scotch" 33 from your supplier today.

REG. U. S. PAT. OFF.
SCOTCH
BRAND
Electrical Insulating Products

3M COMPANY

The term "Scotch" and the plaid design are registered trademarks for the more than 300 pressure-sensitive adhesive tapes made in U.S.A. **by Minnesota Mining & Mfg. Co., St. Paul 6, Minn.**—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N.Y. In Canada: London, Ont., Can.

New Sherman Crimp-Type TERMINAL LUGS

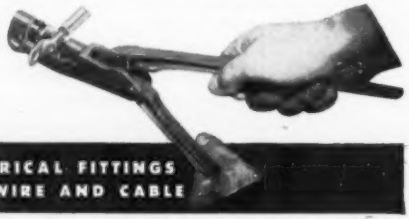
For Commercial Wire

- Wire sizes 8 through 4/0
- Approved by Underwriter's Laboratories when used with the Sherman Crimping Tool.
- Highest grade electrolytic copper, plainly marked with wire size and ampere rating.
- Completely seamless — made under exclusive Sherman patents.

SIZES AVAILABLE

No.	Amp. Cap. N. B. C.	Max. B & S (A. W. G.) Stranded Wire
ST8	35	8
ST6	50	6
ST4	70	4
ST2	90	2
ST0	125	0
ST2/0	150	00
ST3/0	175	000
ST4/0	225	0000

Investigate Sherman Crimp-Type Terminal Lugs — They're Fast, Positive and Economical — *Write for Bulletin.*



H.B. Sherman Manufacturing Co. BATTLE CREEK, MICH.

ELECTRICAL FITTINGS FOR WIRE AND CABLE

You name the Job — Revere ELECTRIC MFG. CO. CHICAGO, U.S.A. has the LIGHTS

150 to 5000 WATT ENCLOSED FLOODS

ELIPTOR 300 to 1500 WATT

SIDE MOUNT LUMINAIRES

TOP MOUNT LUMINAIRES

MERCURY STREET LIGHTS

HORIZONTAL FLUORESCENT ISLAND LIGHTERS

FULL LINE OF AIRPORT FLOODS

FAMOUS REVERE HINGED POLES

WHITE-WAY PYLON-LITES

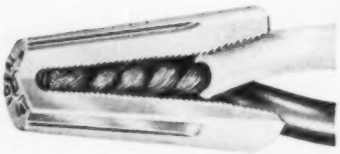
Yes, you name the job and REVERE will furnish the Lights and Poles! You'll save time, eliminate confusion, have a uniform job, with no come-backs.

REVERE equipment sets the pace in all fields—Airport - Service Station - Street - Sports - Outdoor Theater and Industrial Lighting, Better Design, Easier Wiring and Maintenance, Greater Efficiency and Longer Life in Service are your safeguards in specifying and installing REVERE units.

Ask for literature and prices.

REVERE ELECTRIC MFG. CO.

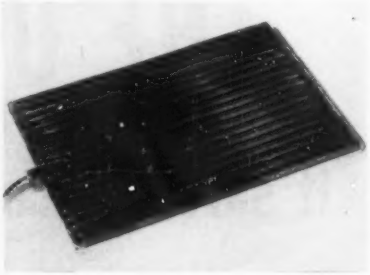
6017 Broadway • Chicago 40, Ill.



Wire Connector (38)

A new screw-on wire connector with one-piece molded plastic threads and body. It is designed for low-cost connections of No. 14, No. 16 and No. 18 wires, and is available in two sizes, A-1 and A-3. Specially developed plastic has high impact strength and excellent dielectric properties. It does not absorb moistures and is impervious to most chemicals. Connectors will withstand temperatures up to 400°F. They are approved by Underwriters' Laboratories for wire combinations from two No. 18 to one No. 14 and two No. 18.

Ideal Industries, Inc., 1041 *Park Ave., Sycamore, Ill.*



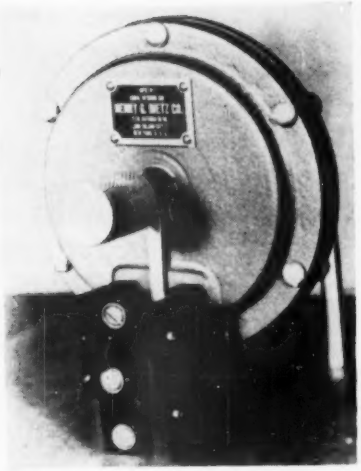
Electric Mat (39)

The Electro Mat is a foot warmer small enough to be moved from machine to machine or from desk to desk. It measures 14 in. by 21 in. and weighs approximately 5 lbs. It consumes as much power as a 100-watt light bulb. Electro Mat is recommended for check stand girls in grocery stores, office workers, industrial machine operators, theatre cashiers, home workshops, elevator operators, telephone operators and hospitals.

Interstate Rubber Products Corp., 908 *Avila St., Los Angeles* 12, *Calif.*

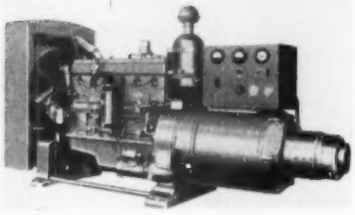
Controls (40)

New improved Cat. 104 sensitive static pressure controls. Units employ new and improved parts, such as molded screw-type terminals, etc. It is also possible to obtain the units with silicone-impregnated glass-cloth diaphragms where operation at high or low temperatures over long periods of time is desired. They are for application on very low pressures where regulation is required in inches of water.



Units have numerous applications in air conditioning, heating and general industry. Units are of small physical size. Controls can be made to operate at any value from 0.3-in. water pressure to 20-in. water pressure with fixed differentials of approximately 10% of operating pressure. Ratings are approved by Underwriters' Laboratories for 10 amperes 125 volts of 5 amperes 250 volts ac.

Henry G. Dietz Company, 12-16 Astoria Blvd., Long Island City 2, N. Y.



Electric Plant (41)

A new 50 kw, 62.5 kva electric plant, Model 50 KA, designed for any type of job requiring heavy duty primary or emergency standby power. It will deliver a full rated 50,000 watts at 80% power factor with ample overload capacity. Powered by an International Harvester gasoline engine, it delivers 104 hp at 1800 rpm and has a 450 cubic inch piston displacement. It is equipped with replaceable cylinder liners, roto exhaust valves, oil bath air cleaner and a remote, 12-volt starting system. Water-cooling, full-pressure oil lubrication with a sump capacity of 9 quarts and a low oil pressure cut-off to protect engine are other features. Generator is of drip-proof design, direct-connected to engine for permanent self-alignment. Voltage regulation is plus or minus 2%. Control box, mounted over generator, is equipped with a charge rate ammeter, electric water temperature gauge, electric oil pressure gauge, start-stop buttons and running time meter. An automatic voltage regulator is installed inside control box.

D. W. Onan & Sons Inc., Minneapolis, Minn.

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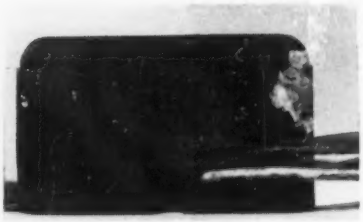


Ballast (42)

A new shallow-light, brick fluorescent ballast, for switch and rapid-start types. Ballast leads extend through elongated slots located ½ inch from base and halfway between center mounting slot and corner mounting holes. It has a nominal height of 1¾ inches and is approximately 10% lighter. Its long smooth side panels facilitate heat dissipation when in contact with the fixture wiring channel. This lead arrangement provides easier mounting independent of type of mounting used, and leads cannot get in way of tools used for mounting.

General Electric Co., Schenectady 5, N. Y.

Message Repeater (43)

A tape recorder the size of a box camera delivers a previously-recorded message whenever a human being walks by the machine. May be used in place of a receptionist where the same message is to be repeated to all callers, as a voice for animated displays, at entrances to model homes to explain features of the home to entering customers, in industrial plants or offices to deliver safety or news messages. Old messages may be replaced by new ones by simply talking into the machine.

Michigan Electronics, Inc., 854 N Rockwell St., Chicago 22, Ill.

Incandescent Lamp (44)

A 200-watt standard-voltage incandescent lamp of the same physical size as the usual 150-watt PS-25 lamp has been announced. The new lamp uses a coiled-coil filament in which the traditional single-coil filament is itself coiled. Designed to replace standard 200-watt PS-30 clear and inside frosted lamps, this smaller lamp lends itself to use in places where the larger bulb would not fit.

Westinghouse Lamp Division, MacArthur Ave., Bloomfield, N. J.

Heating Tape (45)

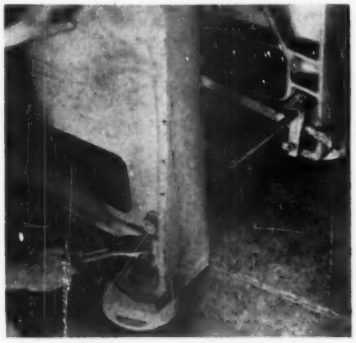
Ribbon Heat is a new flexible plastic, shockproof, electric heating tape. It consists of a 20-ft. to 120-ft. length of plastic tape in which the patented-use wire heating element is sealed. One end of this Underwriters approved tape has flexible leads which can be connected to any 110- or 220-volt approved outlet box. It can prevent freezing of water pipes, also can keep gutters, spouts and drains free of ice. And when imbedded below surface, it can keep walks and driveways free of ice and snow. It has a 7-watts-per-foot rating. Available in lengths of 20 to 60 feet for 110-volt service and from 40 ft. to 120 ft. for 220-volt use. Also available with a plug, in place of leads, for use with any convenience outlet. Specially designed thermostats for use with Ribbon Heat which provide protection against sudden temperature drops are available.

Cox and Company, New York, N. Y.

Lamp (46)

New Hi-spot lamps especially designed for lighting indoor and outdoor areas. Lamps are weatherproof. Bulbs are made of hard glass. They fit conventional medium or mogul sockets. Inside silver reflecting surface stays bright. Available wattages are 300 and 500. Lamps can be used at higher mounting heights for illuminating plant interiors, ship cargoes and docks, parking areas, bridge and tunnel approaches, sports fields, and high lighting of service stations from end poles. Industrial Bulletin No. 83 available.

Radiant Lamp Corporation, 300 Jelliff Ave., Newark 8, N. J.



Isolators (47)

Installing and leveling heavy machinery, without bolting or shims, is now possible with the new series LM3 and LM5 Barrymounts. These vibration isolators lift a machine foot to the required height for leveling by a turn of the attaching bolt. Barrymounted "floating" machines can be moved to central tool rooms for repair. Mountings are engineered to isolate all modes of vibration—horizontal, vertical, rotational. Series LM3 and LM5 permit height adjustments up to ½ inch, and carry loads up to 4,200 lbs. per Barrymount.

Barry Corporation, 1000 Pleasant St., Watertown, Mass.

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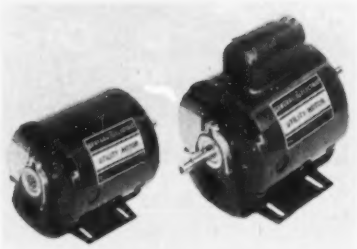

Utility Motors (48)

A new line of utility fractional horsepower motors for shop, home and farm. Of the split-phase and capacitor-start types, motors can be mounted in any position. The split-phase type is rated at 1725 rpm, ¼ hp single shaft, ⅓ hp single and double shaft, and ½ hp double shaft. The capacitor types are rated at 1725 rpm, ⅓, ½, and ¾ hp single shaft; 1725 rpm, ½ hp double shaft; and 3450 rpm, ½ and 1 hp double shaft. All motors are single phase, 60 cycle, and rated at 50 degree Centrigrade continuous rise.

General Electric Co., Schenectady 5, N. Y.

Hand Lamp (49)

Explosion-proof hand lamp for hazardous locations. It weighs 4 and ¾ pounds and only globe guard, globe-holder, and cord connector housing of lamp (Type EVH 103) are aluminum. Both lamp chamber and handle are explosion-proof, separated by lamp receptacle. But flame-tight joints, located along globe-holder, handle and cord connector, prevent an explosion in one compartment from being transmitted into the other. These joints have five or more full threaded turns that after an explosion allow only cooled gases—not flames—to escape. Rubber bushings are supplied with fixture to accommodate ⅜-in. to ⅝-in. portable cord.

Crouse-Hinds Company, Syracuse, N. Y.

Control Switch (50)

A new explosion-proof control switch permits installation of Stanley "Magic Doors" wherever certain hazardous conditions exist. Switch is enclosed in a cast iron housing meeting NEMA Type VII, Class I, Groups C and D requirements for explosive gas atmospheres including locations where atmospheres of ethyl ether, gasoline, petroleum, naphtha, alcohol, acetone, lacquer solvent and natural gas vapors may be present. This development permits installation of Magic Door operators in industrial and hospital locations. Light pressure opens the doors. Control can be located for hand use at elbow height or for tip-toe operation. Explosion-proof switch can be used with all types of Magic Door operators for single, double, and bi-fold swinging doors as well as for single and bi-parting sliding doors.

Magic Door Division, The Stanley Works, 195 Lake St., New Britain, Conn.

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got you all untied?

Answers come fast

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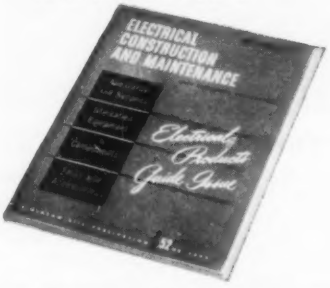
You'll find useful tables of conversion factors, practical calculations, graphical symbols, and Code tables in the TECHNICAL DATA REFERENCE (Pages 5-31) of the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.



. . and for product data that fits to a tee, just refer to the ads in the E P G

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Press Control (51)

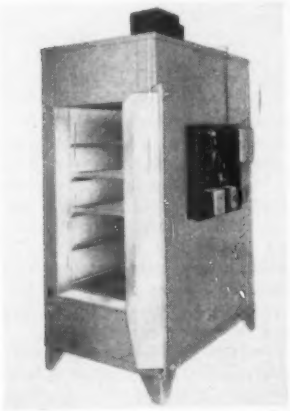
A two-hand clutch control for manually operated power machines, called Micro Trip. It is available as a package for installation on existing presses. It has an instantaneous electrical response, and a light touch actuation. Control device prevents tying down because its two control switches must be pressed simultaneously to operate the press. If one switch is pressed before the other one, the tripping mechanism becomes inoperative and must be reset by a button on control box. Trip may be used with single switch control in applications where one hand is otherwise occupied. Electrical signal systems can be tied in.

Micro, a division of Minneapolis-Honeywell Regulator Co., Freeport, Ill.

Reflector Lamp (52)

R57 reflector lamp for industrial high bay lighting application. It is a complete luminaire in itself. Available in 500 and 750 watts, has a hermetically sealed internal reflector made of silver. It has a rated life of 2000 hours. Recommended for "smog" areas in plants where cleaning lamp reflectors is a constant maintenance problem. Literature available.

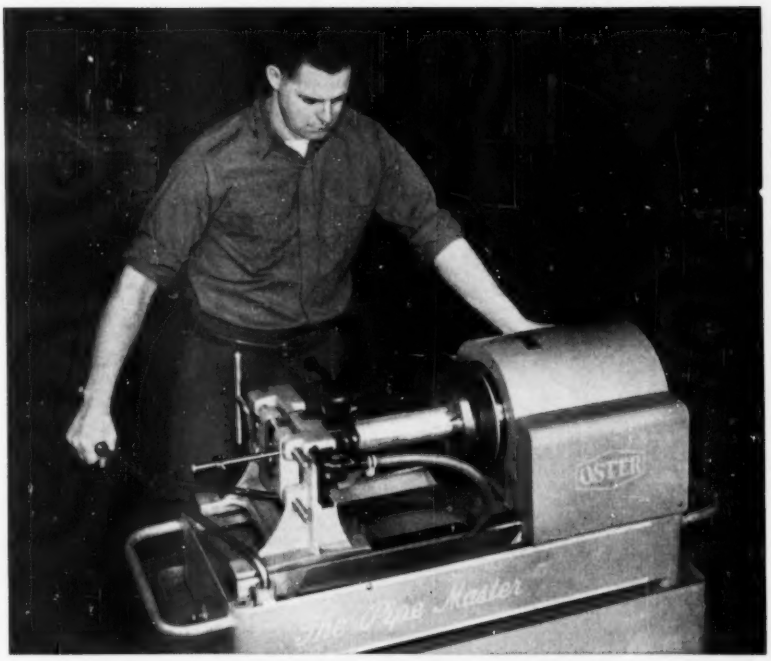
Amplex Corporation, 111 Water St., Brooklyn, N. Y



Oven (53)

Vertical flow cabinet oven with double gasketed doors with heat trap and high-low selective heat intensity control. A high-pressure motor-driven blower propels heated air in a definite air-flow pattern through work chamber, preventing any disturbance due to radiant heat and assuring temperature uniformity. Heating elements are of a special Inconel-sheathed design located in a plenum chamber. All components are accessible. Volume of air flow is adjustable. Ovens are equipped with indicating temperature control; a manual interlock for either rapid cooling or purge period operation of blower without heat; an adjustable positive exhaust and intake; belt-driven fans for motor life. Made in two sizes.

Grieve-Hendry Co., Inc., 1811-19 W. Lake St., Chicago 12, Ill.



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Generator (54)

A new portable electric power generator design has been added to the Cyclohm motor line. It is mounted on a wheelbarrow carriage, which gives it flexibility. All present Cyclohm generator models are available in the portable style. These include 11 ac models, ranging from 350 to 5000 watts output and 9 dc models ranging from 350 to 1500 watts output. They are especially designed for cottages, camps, stand-by service for farms and other rural residences, as well as for use with small portable electric saws, etc.

Cyclohm Motor Corp., Division of Howard Industries, Inc., Racine, Wis.

Foot Switch (55)

A new foot switch, the "Executive", which incorporates two switches in one with selective circuits. It has a baked hammertone gray finish and sets low to the floor, making it comfortable to operate from any heel height. It is the right width for normal foot positioning from one side to the other without excessive leg movement. The principle of the "Executive" is to incorporate two switches in one with selective circuits and guaranteed mechanical interlock. Pivoting from the center, only one circuit can be operated at a time, eliminating the possibility of accidental tripping of two circuits at the same time.

Linemaster Switch Corporation, 428 Woodstock Terrace, Woodstock, Conn.

Electric Ranges (56)

New ranges feature pushbutton controls, extra-high speed Calrod surface units, large-capacity wide-opening ovens, Calrod broiler, and Calrod units throughout. Master oven measures 21 inches wide, 18 inches deep, 15 inches high. All enclosed elements are self-cleaning but may be removed for easy cleaning of oven walls and reflective surfaces. Broil unit is designed with aluminized steel reflector so embossed to permit radiant heat to be reflected in a pattern over the food being broiled. All surface units are of flat-top construction for better contact with cooking utensils. Fuse receptacle and duplex appliance outlet are combined in a single device on back panel. Available in 24-, 36- and 40-in. models.

General Electric Co., 310 W. Liberty St., Louisville, Ky.

Switches (57)

A complete new line of outdoor, group-operated disconnect switches rated 7.5 through 69 kv, 400 and 600 amperes. They are designed for either pole or structure mounting in a horizontal, vertical, or inverted position. Also available are manually operated, interphase mechanism assemblies that may be direct or indirect connected, with or without outboard bearings. Switches feature silver-insert-to-silver-insert high-pressure contacts, which are field adjustable; all bearings and moving joints are lubricated with silicone grease for life and sealed by silicone cord rings; rotating switch blades; a fewer number of current interchange points for cool operation; and adjustable terminal clamps.

Line Material Co., Milwaukee 1, *Wis.*

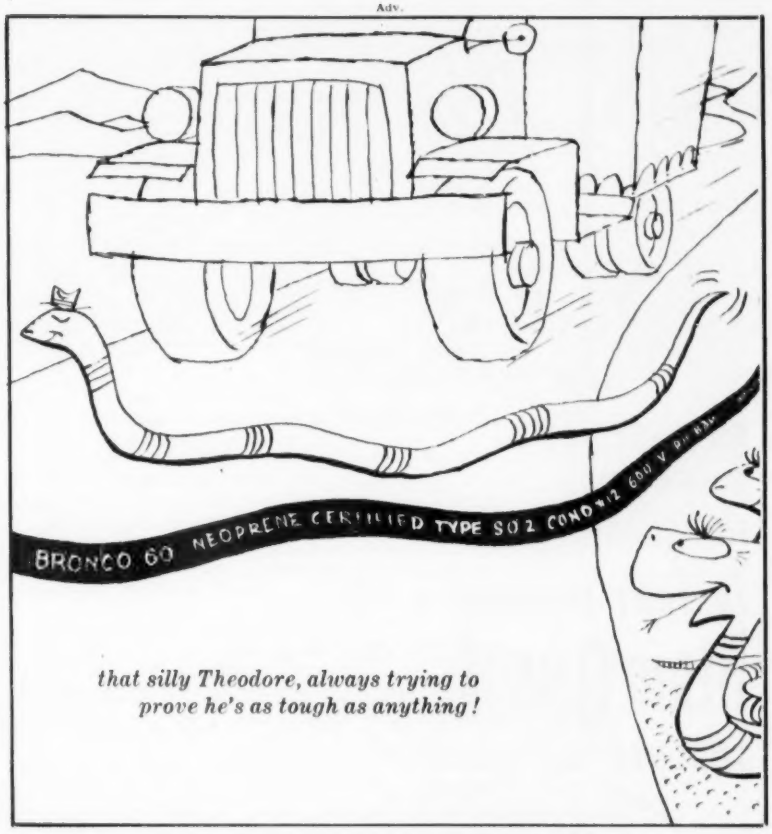
Product Briefs

(58) A precision-made **instrument** called the Krollometer has been developed by Christensen and Kroll, McMinnville, Oregon, for translating angles in degrees to inches per foot drop, carpenter square measurements and percentages of grade . . . . (59) Tect, Inc., Dumont, N. J., is producing a new **safety solvent** called Tecsolv which has same evaporation rate as carbon tet yet is only ⅓₀th as toxic . . . . (60) A heavy duty flight-type helix **auger** in sizes of 16, 20, 22, 24, 30 and 36 inches diameter, especially designed for large jobs, is announced by Petersen Engineering Co., Santa Clara, Calif.

(61) CSI cable splice **rubber tape** with extreme cohesive properties making it possible to apply lengthwise without winding has been made available for industrial, commercial and transportation use by the CSI Sales Company, Solon, Ohio . . . . (62) Solar Electric Corp., Warren, Pa., has produced a new 150-watt "kitchen light" **incandescent bulb** with white inside-silica coating to reduce glare factor and eliminate shiny reflections . . . (63) New line of 2-, 3-, and 4-groove **V-belt sheaves** ranging from 7.0 to 18.4 inches in diameter and having a bushing bore range of ½ to 1¾ inches has been added by Browning Mfg. Co., Maysville, Ky.

(64) Ingersoll-Rand Co., New York City, announces new size **2U Impactool** for nut-running, tapping, screw driving, reaming and drilling which delivers powerful rotary blows to work without twist or kick to operator when turning resistance is met . . . . (65) General-purpose **metal detector** manufacturing processes which will discover metal particles in packaged food products, metals in non-magnetic and non-conductive types of ore, or metal on logs in paper and lumber industries has been developed by General Electric Co., Schenectady 5, N. Y. . . . (66) Glide-Rule **drawing instrument** manufactured by Smith Drake Corporation, Inglewood, Calif., may be carried in pocket, combines triangles, T-square,

Adv.



that silly Theodore, always trying to prove he's as tough as anything!

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A few easy strokes with this specially designed brush safely remove corrosion from any size wire . . . even down between the strands. Clean wires mean less resistance, less heat . . . a better connection. Kearney Conductor Cleaning Brushes are available with a sure-grip insulated handle, or with a universal fitting for Fit-On poles.

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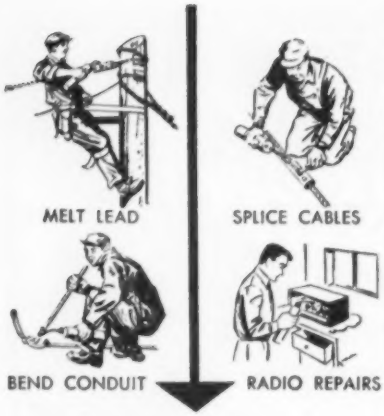

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(67) Concentrated solvent emulsion cleaner for cleaning of oils, dirt and grease from metal surfaces is available from Brulin & Co., Inc., Indianapolis 3, Ind. . . . (68) Ampower Products Co., Oak Lawn, Ill., announces portable **spot welder** with enclosed electronic timing control permitting timing cycle of $\frac{1}{60}$th of a second to 1 second . . . . (69) A new spring steel coil form **fastener** called speed clip has been developed by Tinnerman Products, Inc., Cleveland 1, Ohio, designed to furnish a maximum of stability and fine tuning adjustment.

(70) E-Z Cut drill attachment for ¼-inch portable **electric drills**, manufactured by Jaco Devices, Hingham, Mass., converts drill into power sabre saw for work on metal, wood, plastic or composition board . . . . (71) Lenk Mfg. Co., Boston, Mass., has introduced the LP liquified petroleum **torch** to make possible use of either a needle-point or a blast flame for soldering, sweat fitting and light brazing . . . . (72) New Guillotine hydraulic angular **bolt cutter** designed for flush trimming bolts up to ⅞ inch to the nut or for other metal trimming jobs where a close cut is desired is announced by Manco Mfg. Co., Bradley, Ill.

(73) Three new series of **air tools** (Nos. 3, 35 and 5) covering applications from ¼-inch drilling to direct- or right-angle-drive ¾-inch bolt size nut setting have been announced by Thor Power Tool Co., Aurora, Ill. . . . (74) Model B-202-M siphon **spray gun** offered by John B. Moore Corp., Nutley, N. J., draws cleaning fluid directly from 55-gal. drum, facilitates spray cleaning by solvent, emulsion or aqueous solutions . . . . (75) Ten-key Model 99 automatic printing **calculator** which provides quick solution and permanent tape record for any problem involving automatic multiplication, division, addition or subtraction is announced by Remington Rand Inc., New York 10, N. Y.

(76) Mica Coating Products Co., Inc., Salem, Mass., has announced a mica-coated **Fiberglass cloth** suitable for transformers, core windings, condensers, high speed motors and other electrical applications, available in 25-, 50-, or 100-yard 36-inch rolls . . . (77) A commercial **bearing** having carburized and hardened raceways suitable for business machines, washing machines, power mowers, and small electrical motors is being made by Schatz Mfg. Co., Poughkeepsie, N. Y. . . . . (78) **Heat regenerator** extracts heat from air being exhausted from industrial applications, is applicable to any drying process making use of heated air. Manufactured by Therm-O-Wheel, Inc., Far Rockaway, N. Y.

(79) Kohler Co., Kohler, Wis., has redesigned its 2- and 3.5-kw manually-started **electric plants** for kerosene-gasoline operation.

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(81) ALUMINUM WIRE; uses and properties of aluminum for power and lighting wire including eight tables on insulation, current-carrying capacity, and other characteristics. 30-page handbook. United States Rubber Co.

(82) CODE CHANGES for wire, cable and conduit condensed on handy wall chart; front contains quick reference chart of all presently approved wire and cable insulations, their allowable temperature ranges and uses; reverse side shows all other code changes for wire, cable and conduit. Triangle Conduit and Cable Co., Inc.

(83) TESTING INSTRUMENT for checking and calibrating of current-actuated devices such as motor starter overload relays, current transformers, circuit breakers, reclosers, sectionalizers, fuse links and meters. Multi-Amp Corp.

(84) DRY-TYPE TRANSFORMERS, their operation and maintenance; trouble-shooting chart; explanation of nameplate terms. Hevi Duty Electric Co.

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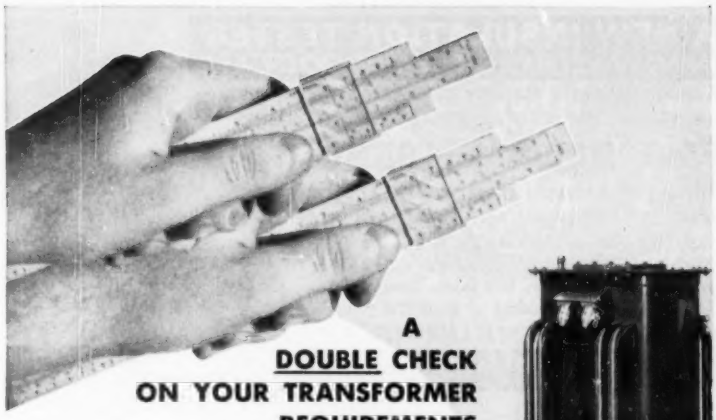

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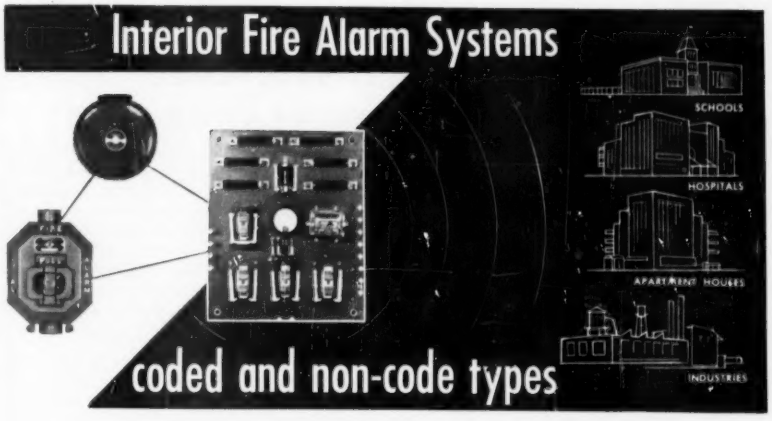

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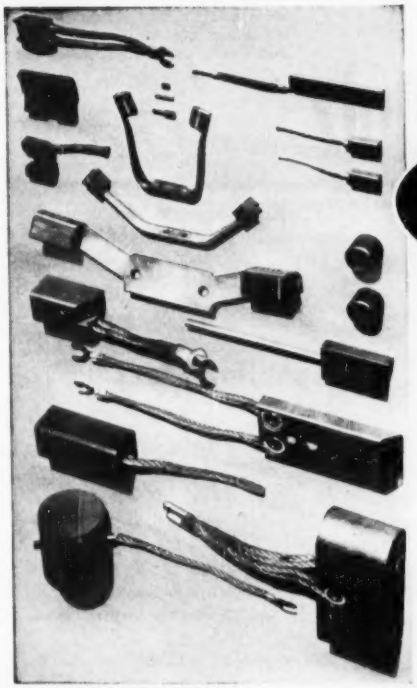

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Reader's Quiz

Compound Wound DC Motors

QUESTION G24—We have a 15 hp, 230 volt dc compound motor with interpoles on which we had to use substitute brushholders. On test without load the motor ran fine and was easily reversed by reversing fields or armature current. However, when we connected it under load it would run only in one direction and we could not reverse it as we did under test. After experimenting we found that after we shifted the brushholders we could reverse it. Could someone explain why the motor could not be reversed before shifting brushholders?—S.R.U.

ANSWER TO G24—When load is applied to a dc motor, some of the field flux is crowded towards the leading pole tips. This causes the neutral axis to be shifted to a new position against the direction of rotation by a small angle. Unless some compensation is made for this shift in the field flux, serious sparking is liable to occur.

A commutating or interpole field is used to minimize this distortion of the field. Also, with a commutating field, there is no shift of the neutral axis from no load to full load.

When commutating poles are used on a motor, the conductors must first pass under a field pole and then a commutating pole of like polarity; that is, first under a south field pole and then under a south commutating pole. If this arrangement is not true, the commutating field will oppose and distort the shunt and series fields, especially when the motor is loaded.

It appears that the motor in question may have been disassembled and reassembled in such a manner that when the fields were in their proper relation to each other, the brushholders were 90 electrical degrees from their proper neutral axis. This may have been the reason that substitute brush holders had to be made in order for the motor to perform properly.—W.E.N.

ANSWER TO G24—In a dc motor the armature current flows against the induced or counter EMF. With the brushes in the neutral plane the motor would run in either direction *at no load* by reversing either the field or the armature leads, but not both. Due to the effect of self inductance, the brushes must be shifted against the direction of rotation if the motor is to be run *loaded*. This is also true of generators.—E.E.M.

Capacitor-Start Motor

QUESTION H24—I have had the experience of having a ¾ hp, 110-220 volt, single phase, 3450 RPM capacitor, motor destroy its centrifugal switch. Not having any replacement parts, and no other harm done, I replaced the centrifugal switch with a toggle switch so the motor could be used.

This proved satisfactory as far as using the motor, but one thing puzzled me. When I opened the line switch and a few seconds later closed the start toggle switch, the motor slowed down in speed, but not to a complete and sudden stop. I would like an explanation for this.—W.R.B.

ANSWER TO H24—When the starting switch in the capacitor-start motor is opened during or after an accelerating period, a charge directly proportional to the instantaneous voltage across the capacitor at the time of interruption remains in the capacitor. After the line switch is opened and the starting switch closed, either manually or by deceleration of the motor, the capacitor discharges itself through the main and auxiliary windings. This discharge takes place in a series circuit consisting of the capacitance of the capacitor, the inductance of the main and auxiliary armature windings, and the resistance of the main and auxiliary windings; and accordingly the current in the circuit oscillates and decays in amplitude with time. This current in the main and auxiliary windings creates a field which in turn induces a magnetic field in opposition to it in the rotor. The reaction of the armature field on the rotor field acts as a brake and tends to decelerate the motor. Since the oscillating current in the armature windings decays prior to the stopping of the rotor, the rotor will not come to a complete stop as a result of this phenomenon, but will depend on friction and windage alone to absorb the remaining potential energy in the rotating mass.—J.S.

ANSWER TO H24—I had a similar condition on single phase motors, capacitor or induction.

A single phase induction motor has no revolving field at stand-still and no inherent starting *torque*. Therefore it is necessary to employ a starting device of some sort for any single-phase induction motor. The means employed for starting are many, and the different types of single-phase induction motors are named after the method employed for starting them, such as the split-phase induction motor, the capacitor-start motor, the repulsion-start, and the reactor-start motor.

All the above mentioned motors have two windings, both of which are connected in parallel with a starting device in series with the starting coil winding (in your case, a toggle switch).

However, when the motor is up to speed (3450 rpm) and you remove (disconnect) power from the motor, and you reconnect your starting coil circuit, the momentum of the rotor will build up an E.M.F. that affects the continued speed, thereby slowing the motor speed down but not to a dead stop. This E.M.F. build up continues so that it actually runs the motor. Eventually, the friction of the moving parts and the drag of the magnetic flux (which is small) stops the motor. When the restarting (toggle) switch is applied you put the running and the starting windings in a parallel, and the motor becomes a generator in itself.—O.C.

Fluorescent Starter

QUESTION J24—To return to the subject of whether a fluorescent starter can be of somewhat different rating than the bulb it operates, and still be dependable, has anyone run into the circular fixtures where two sizes of bulbs are controlled by one starter?

If I use a starter small enough so that the small bulb will always start, the large bulb will fail once in a while. Also the small one will occasionally fail if I use a starter large enough for the large bulb.

The only thing I can see to do is install another starter and starter socket, but is there any better method?—M.C.T.

ANSWER TO J24—The 22 watt

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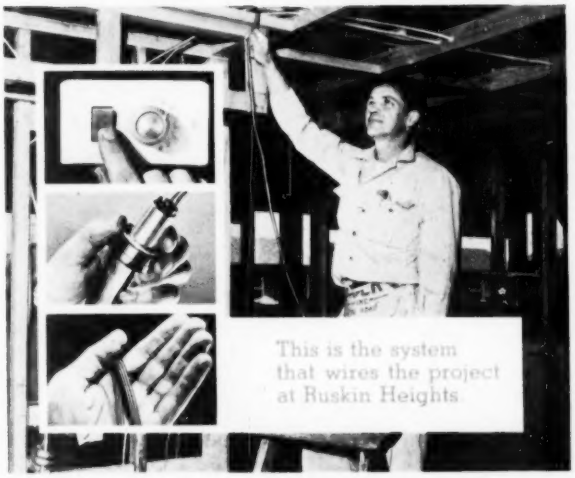

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*TYPE LVD. For high capacity, low voltage drop, feeder applications, or as a riser in multi-story buildings carrying high currents over long distances, 600-4000 ampere ratings, to 600 volts.

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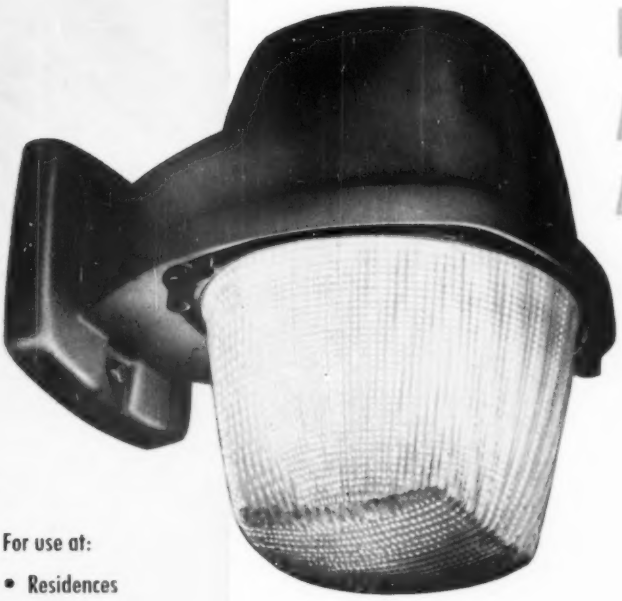

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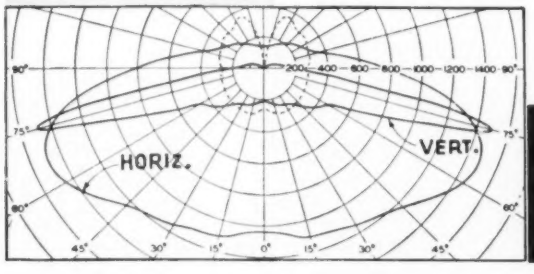

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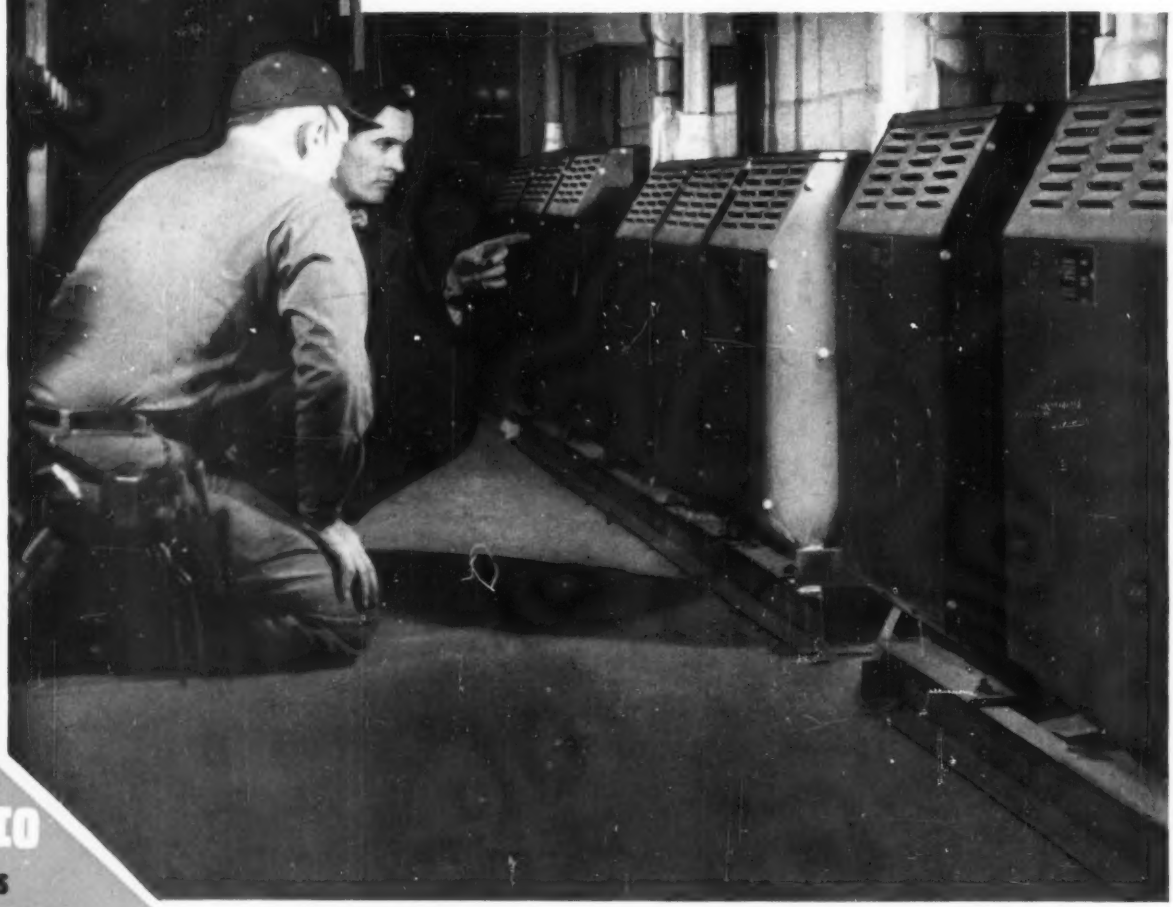
674-184

GENERAL ELECTRIC



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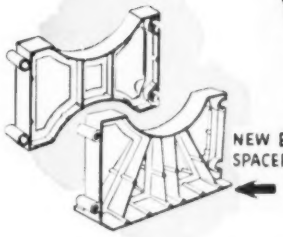

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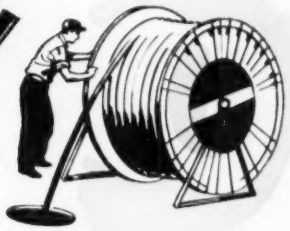

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These advantages have created an acceptance that keeps Orangeburg a leader in every city and state.

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bulb has to use a 15 to 20 watt starter, while the 32 watt bulb has to use a 32 or 40 watt starter in order to be dependable. You are using a ballast with a wrong inside connection. Changing the ballast and using two starters will give good results.—H.S.

Neutral Current

QUESTION K24—In the section where I live and work we are confronted with a problem. The four wire-three phase WYE connected service system is coming into general use, and nowhere in any of my text books can I find a mathematical formula for determining the load on the neutral conductor of an unbalanced lighting panel?—L.E.H.

ANSWER TO K24—Text books in general will as a rule only indicate the general principles of the four wire three phase systems. However if the questioners will review an article in the August 1952 issue of *Electrical Construction and Maintenance* he will find an article by B. A. McDonald covering the subject as clearly and thoroughly as this writer has seen.

The solution, as mentioned in the article, involves the principle that the sum of all currents entering or leaving any point in a circuit or network at any instant must be equal to zero. Assuming that the three phase currents are known, they may be equated to the negative of the neutral current and solved either mathematically or graphically by means of vectors. Since so many possibilities exist with respect to power factor, etc., it is impractical to set up a specific formula. A step-by-step solution as outlined in the article is the preferred method of approach.

Very helpful in this respect is a book published by Scama Publishing Co., New York, entitled *Scama Electrical Voltage Drop and Unbalanced Neutral Current Tables* by Arthur J. Scala, Consolidated Edison Co.—C.O.D.

Rewinding A Motor

QUESTION L24—We have a single phase motor which needs to be re-wound, but we find it uses aluminum wire. Can we rewind this motor with copper wire? Would you use the same size wire and the same number of turns as were used with the aluminum wire?—R.E.G.

ANSWER TO L24—Yes, the motor can be re-wound with copper wire. However, one fundamental formula must be kept in mind:

This is what we call a "DEAD-END"
If you just hand wrap it around a strand, rope or rod, like this...
you can pull, like this...
50,000 POUNDS PULL
until the strand, rope or rod breaks,
But the "Dead-End" never lets go!

Among its many profitable and proved applications are:

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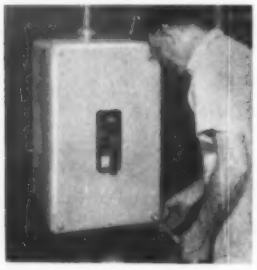

You can put your confidence in—

GENERAL ELECTRIC

The magnetomotive force required to drive *any* motor is proportional to the product of the number of turns times the amperes.

Because the current carrying capacity of an aluminum conductor is less than that of the same size copper conductor (84%), either the number of turns or the wire sizes must be reduced. Failure to follow either of these two courses will result in overheating of the motor.

Again, however, we are faced with a problem. Whether you use the smaller size wire or the same size wire with fewer turns, you will still have to fit a lesser amount of wire in the same size stator. To build up the winding, thicker wrappings, larger mounting plugs, may be used.

In all instances, remember that the magnetomotive force, the product of the number of turns time the amperes, must be maintained at the original value. Either factor may be varied as long as the product remains the same.—R.A.M.

ANSWER TO L24—Any motor wound with aluminum wire can be rewound with the same size copper wire. In general, rewinding with copper wire will improve the efficiency of the motor, since aluminum wire has twice the resistance of copper. Use the same turns in the winding, and the torque characteristics will remain approximately the same as before, the motor efficiency higher, and the operating temperature will be lower because of the higher efficiency.—E.E.E.

Commutating Field vs Series Field

QUESTION M24—Will a stronger commutating field take the place of a stronger series field?—H.S.

ANSWER TO M24—The purpose of a series field, disregarding the compensating type, is to modify the internal torque in the case of a motor, or the generated voltage in the case of a generator. The purpose of the commutating winding is to counteract the field distortion created by field pole saturation, due to the combining effects of the armature and rotor fields. Accordingly, introduction of the commutating field reduces the sparking at the neutral position of the brushes. Due to the physical location of the commutating poles, it is impossible to effect any changes by its adjustment comparable to those obtainable by adjustment of the main series field. Incidentally, an unnecessarily strong commutating field may cause excessive

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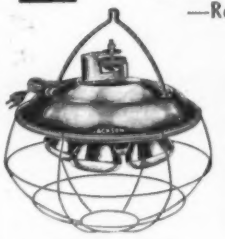

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sparking at the brushes under load.

ANSWER TO M24—The series and commutating fields are entirely different, and increasing the strength of one will not permit elimination of the other.

A series field is a productive part of the machine. In a generator it helps produce voltage; in a motor it develops torque. Generally it is used in conjunction with a shunt field, and both are wound together on the same pole piece. The series field is most effective at full load, since it carries armature current, and in a generator it tends to hold constant voltage from no load to full load, while in a motor it gives speed and torque characteristics not found in shunt motors.

The commutating field, or interpole, unlike the series field, contributes nothing to the output of the machine except more satisfactory performance. —D.H.N.

Can you ANSWER these QUESTIONS?

QUESTION A25—We had a 75 hp slip ring motor, on 2300 volts, driving a pump. This motor was overloaded so that the rotor winding heated and burned the insulation off the coil ends. The stator winding was not damaged. The rotor is 90 slots, with 5 turns to the coil. Can the five turns be bonded together instead of being insulated as a coil? Would this bonding produce excessive heat?—E.S.H.

QUESTION B25—From time to time we find it necessary to change a direction of rotation on repulsion induction motors. Can someone suggest an easy, accurate method of locating the point where peak starting torque occurs when no brush setting is indicated?—H.G.C.

QUESTION C25—Can any reader supply a simple garage remote control door opener circuit using a radio transmitter and receiver? Do these units require Federal Communications Commission approval for operation?—L.W.F.

QUESTION D25—In a 110-220 volt 3 wire ac neutral system, the ground connection has 1000 ohms resistance and a person touches a live wire. What voltage does he get through his body? —R.S.

PLEASE SEND IN YOUR ANSWER BY JANUARY 15

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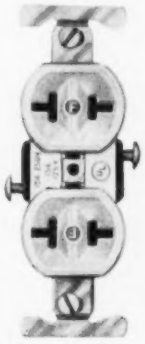

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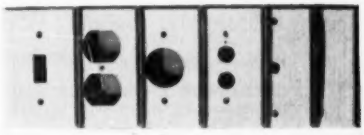

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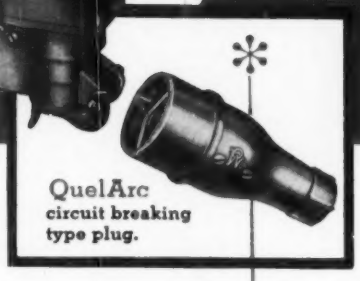

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COMPLETE SAFETY FOR THE OPERATOR is provided by safety circuit grounding and the interlocking of door and plug receptacle with a quick make and break switch mechanism.

Consult your Pylet Catalog, Bulletin 1150 for complete listings.

PYLE QuelArc plugs, used with this equipment, are well known industrially, for their unique partitioned construction. Long insulating surfaces from pole to pole, and from poles to ground provide for exceptionally safe handling and long service life.

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Questions on the Code

Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

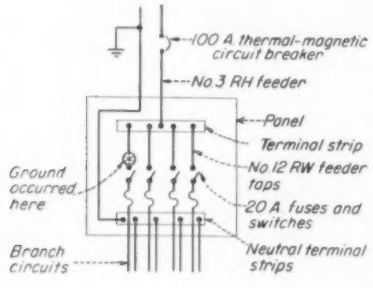
Service Switch

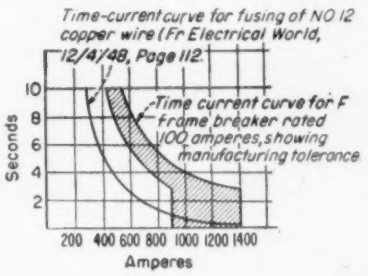
Q. *When answering a trouble call at a small store building, I found a 60 ampere service switch seriously overheated even though it was fused with 35 ampere fuses and the total load amounted to only 33 amperes on one leg and about 30½ amperes on the other leg. How could such a load cause an approved switch to overheat?* —M.K.

A. Enclosed fuse switches should not be expected to carry more than 80% of the rating of the fuses used as a continuous load due to the fact that they are unable to properly dissipate the heat generated by the fuse elements. The zinc alloy element of a fuse carrying practically its rated capacity is very near the melting point of that alloy and this heat being confined within an enclosed cabinet continues to build up under continuous load conditions until the contact pressure between the fuse clips and the fuse ferrules decreases. When that occurs, that too causes heat, bringing about eventual destruction of the device. For that reason no enclosed fuse switch should be expected to carry continuous loads in excess of 80% of the rating of the fuse used within them. —G.R.

Five Foot Tap Rule

Q. *The sketch below shows a recently installed lighting feeder circuit in simplified form. A ground occurred at one of the branch circuit fused switches in the panelboard. Before the 100-ampere circuit breaker opened, the No. 12 wire feeding the faulted switch melted. Reference to the time current curves shows that below 900-amperes it is impossible for the 100-ampere breaker to protect a No. 12 wire.*




Time-current curve for fusing of NO 12 copper wire (Fr Electrical World, 12/4/48, Page 112.
Time current curve for F frame breaker rated 100 amperes, showing manufacturing tolerance
Seconds
10
8
6
4
2
200 400 600 800 1000 1200 1400
Amperes

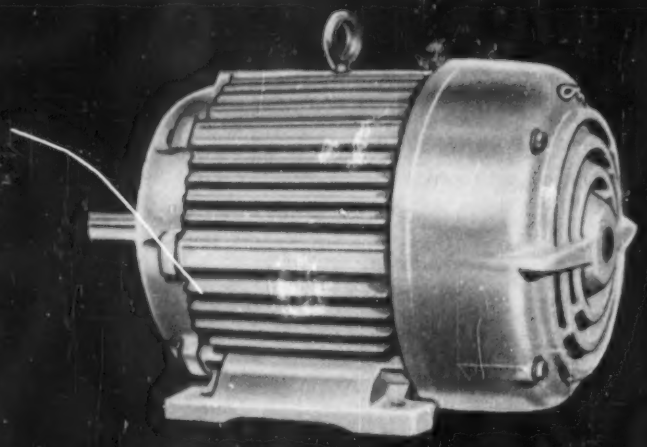
The NEC is not easy to interpret regarding over-current protection of feeder taps, but it appears that Paragraph c of Section 2434 governs in this case, and the illustrated installation meets the requirements. Was it the intention of the Code to permit such a degree of under-protection?—*A.R.K.*

A. I agree with your contention that Section 2434-c of the Code recognizes the No. 12 tap as shown by your illustration and to further aggravate the matter, the overcurrent protective device protecting the feeder could be larger than a 100 ampere circuit breaker in line with the size of the feeder and the panel involved. The so-called 5-ft. tap rule first appeared in the 1931 edition of the NE Code under Section 805-d. At that time, it was referred to as an "Unfused Tap". Your time-current curves prove to a considerable degree that this term is correct, especially when the load served through the tap consists of only one or a few branch circuits.

I believe the Electrical Committee which developed this rule fully realized, in some cases, that such 5-ft. taps would have little if any overcurrent protection but I am also inclined to believe that the reasons in support of such a provision justified the action taken. Occasionally, in the development of Code rules, situations arise where a choice must be made between two evils and usually the lesser is selected. This I believe to be the case in the problem you have presented. Only time and field experience proves the decision to be right or wrong, and I personally believe that this 5-ft. tap rule, with a field experience of over 20 years, has fully satisfied the minimum requirements for safety as established under the "Purpose and Scope" of the Code. The failure, which you have presented, involved a fault to ground and it is my experience that the variables involved with grounds occasionally result in a combination where conductors fully protected will be destroyed. While such failures could be reduced by more rigid standards, the question of a reasonable degree of safety consistent with practical considerations and based on field experience, should be considered.

Section 2434-c of the Code is an exception to the general provision that all conductors must be properly protected, and there are good reasons for its existence. I believe we all recall the days when a riser passed through several cabinets and it was a Code violation to connect a small panel, through a tap, to the riser without fusing the tap, even though it might be less than a foot in length. This particular application was a very important consideration in the recognition of the exception, and I believe the percentage of a wiring installation which is involved with this rule is very low. It also follows that the case of failure you present, where the tap only feeds one branch circuit, is the worst condition covered by the rule. When panels with several branch circuits are involved, the taps will be much larger in proportion to the feeder size and in most cases will be larger than the load to be served through the panel as computed by Article 220.

The foregoing comment does not intend to discount the importance of the failure presented. We all should learn something from such cases and if they do become noticeable or frequent, I am sure action would be taken to rectify the weakness. I believe, in this instance, that the range between what is possible and what is probable is rather wide and that the rule in question in view of its existence for 20 years shows the probability of failure to be small.—B.A.McD.



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Reduced Neutral

Q. *Where a common neutral conductor is installed, may the size of the neutral be made smaller as the number of ungrounded conductors associated with this neutral, is decreased?*—J.T.

A. The common neutral is now permitted only for feeders, see Section 2204 or for outside wiring, see Section 7312. At one time, up to and including the 1937 Code, the common neutral was also permitted for branch circuits. The 1940 Code for the first time deleted this permissive rule, the intent being that it could not be used for branch circuits. The permission to use the common neutral for branch circuits for outside wiring did not appear till the 1947 Code.

Now with respect to the particular use of the common neutral for feeders as outlined in Section 2204 (and basically the principle is the same for Section 7312 even though branch circuits are involved); they can only be used for

a. two sets of 3 wire feeders, or
b. three sets of 3 wire feeders, or
c. two sets of 4 wire feeders, or
d. two sets of 5 wire feeders.

It will be noted that such construction is set to limit the total number of conductors to nine or less feeder cables. Actually for "a" a total of five wires is involved, for "b" and "c", seven wires must be used and for "d" the maximum number of nine wires would be used.

When considering the common neutral system which would result in the relatively most complicated neutral design, the case of the three sets of 3 wire feeders would be the most involved one. Schemetically the following diagram shows such a system which will illustrate all the problems and calculations involved.

Basically the neutral must under all conditions carry the maximum unbalanced load, see 2203g, so that in effect this will permit the neutral to be decreased in size between points "A" and "B", between point "B" and the panels for loads 2 and 3, and between point "A" and the panel for load 1.

The actual feeder size required for each individual panel, disregarding any demand factors, etc., we will say, will be determined by the branch circuit ratings. In this case each panel imposes a maximum load of 3 x 20 amperes or 60 amperes total per phase. Each feeder then will have to be at least three No. 6, Type RH conductors (see Table 1) in 1" conduit (see Table 4). This will also be true for the section of the feeder from point "B" where the second feeder drops off to get panel No. 2, to the point where this line terminates at panel No. 3.

From point "A" to point "B" the conduit line contains five wires. Four of these must be No. 6 Type RH. The neutral wire must be capable of carrying the maximum unbalance of two panels or 2 x 60 amperes. A No. 1 Type RH with a carrying capacity of 130 amperes will be sufficient.

The area of a No. 6 RH is .1238 sq. in. and of a No. 1—.2715 sq. in. (see Table 13). The total wire area would be

4 × .1238 or	.4952 sq in
1 × .2715 or	.2715
	.7667

At 40% fill the minimum conduit size would have

.7667/.4 or 1.917 sq. in.

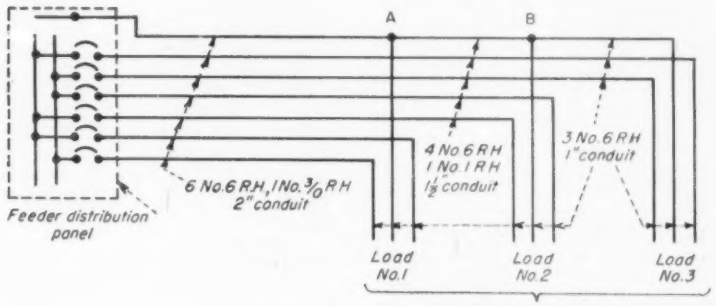
Table 19 shows a 1½ in. conduit with 2.04 sq. in. as the minimum size to use.

The conduit line from the main panel to point "A" would contain six No. 6 RH wires and a neutral having a minimum capacity of 3 × 60 or 180 amperes, viz., 3/0, Type RH. The calculations are as follows:

6 × .1238 or	.7428
1 × .4151 or	.4151
	1.1579

As above, the area would be 1.1579/.4 or 2.895 sq. in., requiring a 2-inch conduit (3.36 sq. in. area).

Actually other considerations may be taken into account. For example, the only way a maximum unbalance of 180 amperes could be obtained would be for the three feeder breakers on one phase in the main panel to open. It is also possible that the service line feeding this main panel may have one phase out due to the opening of a main service overcurrent device. Regardless of any other considerations the above does indicate the treatment for the common neutral conductor size.—B.Z.S.



Basically the neutral must under all conditions carry the maximum unbalanced load, Sec. 2203g, so that in effect this will permit the neutral to be decreased in size between points "A" and "B", between point "B" and the panels for loads 2 and 3, and between point "A" and the panel for load 1.

The actual feeder sizes required for each individual panel, disregarding any demand factors, etc., we will say will be determined by the branch circuit ratings. In this case each panel imposes a maximum load of 3 × 20 or 60 amperes per phase. Each feeder then will have to be at least 3 No 6, Type RH (see Table 1) in 1 inch conduit, (see Table 4). This will also be true for the section of the feeder from point "B" where the second feeder drops off to get panel No 2, to the point where this line terminates at panel No 3.

From point "A" to point "B" the conduit line contains five wires, four of which must be No 6 Type RH. The neutral must now be able to carry the maximum unbalance of two panels or 2 × 60 amperes. A No 1 Type RH with a carrying capacity of 130 amperes would be used.

Pull Boxes

Q. *Can we have pull boxes made up by a local metalworker for use in a feed grinding mill or must the boxes be listed for use in a Class II location?*—

A. If you will carefully follow the provisions contained under Section 5054, there is no reason why you could not have a metalworker construct a pull box which you could use in a feed mill and conform to the requirements of the Code. Under this section you will note that fittings and boxes shall be provided with threaded bosses for conduit connection and, furthermore, that they should be constructed so tightly that there are no holes through which dust might enter or through which sparks or burning material might escape. You will also note the Code states such boxes shall be approved for Class II locations only when they are located in the presence of electrically conductive dusts.—G.R.

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24 Volt-125 Volt Conductors—Same Conduit

Q. *I have a question in regard to electric door openers. I would like to know if there would be a violation to Section 7292-2 to install the 24 volt control wires between the control panel and the timer in the same conduit with the 115 volt power circuit wires. If there are no violations to the National Electrical Code, what type of insulation must be used for the low voltage control wires?—E.C.H.*

A. Section 3011 of the Code permits conductors of a light or power system and conductors for remote control to occupy the same raceway with the exceptions covered by Section 7266 and 7292. Reference to Section 7292 shows that any remote control conductor which is classified as a Class-2 circuit cannot be placed in the same raceway with conductors for either light and power circuits. Section 7266 permits conductors of two or more Class-1 remote control circuits to be installed in the same raceway with the power supply conductors provided all conductors are insulated for the maximum voltage of any conductor in the raceway and also remote control conductors of a Class-2 system provided such conductors are insulated and installed as required for a Class-1 system. Section 7264 covers the insulation required and Section 7265 covers the installation requirements. As a result of these Code rules, we could, under the conditions covered, install the 24 volt control wires in the same conduit with the 115 volt power circuit wires provided 600 volt insulation were used on all conductors involved.

While there appears to be a conflict between the requirements of Section 7266 and 7292, I believe a careful study of both rules shows that such is not true. I do believe however that a reference should be made under Section 7292-A-2 to the exception covered by Section 7266. If such a reference had been inserted, it is evident that there would have been no occasion for your question.—B.A.McD.

Wiring for Hospital

Q. *Is the recovery room in a hospital where combustible anesthetics are used for anesthesias considered as a Class I location?—P.A.D.*

A. For the first time the 1953 edition of the National Electrical Code contains the rules governing the wiring of those portions of a hospital where combustible anesthetics are used and under paragraph 2 of Section 5135 you will note that a recovery room is not to be classed as an anesthetizing location unless it is used for administering combustible anesthetics. Practices in different hospitals differ widely and in some it is common to find that in the recovery room they may have one or more anesthetizing machines. In some hospitals the recovery room is used for administering the initial anesthetic to the patient; in others, the recovery rooms are used solely for post operative patients; and in some cases it is necessary that an anesthetic be given following completion of an operation. In the latter case, in hospitals which operate on a rather tight schedule this may be done within the recovery room, in others such patients could, of course, be returned to an operating room for being given further anesthesia. It therefore will be necessary for you to be advised by the hospital management as to the use their recovery room will be given before determining whether or not it must be wired as is required by the Code for anesthetizing locations.—G.R.

Direct Burial Cable

Q. *Would you say that a single conductor wire placed in earth (direct burial) 12 to 36 inches would be equal in carrying capacity of same conductor in free air?—J.P.R.*

A. I believe the question will be definitely answered by the 1953 Code. Table 1 of Chapter 10 has its subcaption amended to read "Not more than three conductors in Raceway or Cable or Direct Burial". Therefore, the free air capacity cannot be used.—B.Z.S.

20 Ampere Circuit Loading

Q. *May a 20 ampere, 115 volt circuit supply 20-2 lamp fluorescent fixtures, each fixture is rated at .85 amperes? The loading is not for long periods of time. From a practical standpoint and to reduce panel heating, we have been limiting the above circuit to 10-12 fluorescent fixtures.—P.P.G.*

A. According to Section 2125 of the Code, a 20 ampere branch

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circuit may supply a maximum load of lighting fixtures in the amount of 20 amperes provided the load will not continue for long periods of time. The fluorescent fixture load shall be based on the ampere rating and not the wattage of the lamps. In the case in question 20-.85 ampere fixtures would produce a load of 17 amperes. This, in my opinion, would be recognized by the Code in any of the occupancies listed in the table in section 2203 b. (See Section 2116). If the occupancy was not covered under this table a minimum of one and one half amperes must be figured for each fixture. Your observation with respect to panel heating is important in this regard. If we make a practice of loading the branch circuits in a panelboard at or near their full rating, we are certain to obtain abnormal heating unless the panel is specially designed for such circuit loading. This feature should always be considered when specifying the load on a branch circuit.—B.A.McD.

Grounded Conductor

Q. *I recently left a correction ticket on an installation in a fair sized industrial plant where the electrical contractor carried the neutral of a four wire service straight through the disconnect switch to the first distribution cabinet which was located in another room at some distance from the service equipment and meter. The contractor now claims this complies with the Code inasmuch as one can disconnect this grounded neutral from the ground terminal connection in the first distribution cabinet. Was I not correct in refusing to accept this installation?*—A.T.F.

A. Yes, you were correct in refusing to accept such an installation as it apparently contains two violations of the National Electrical Code. Under paragraph c. of Section 2351 you will note the following:

"If the switch or circuit-breaker does not interrupt the grounded conductor, other means shall be provided in the service cabinet or on the switchboard for disconnecting the grounded conductor from the interior wiring."

Then under Section 2523 you will note that secondary alternating-current circuits shall have a connection to a grounding electrode at each individual service and inasmuch as one cannot consider a distribution cabinet as service equipment unless it is located adjacent thereto, the installation in question is certainly in violation of the Code requirements.—G.R.

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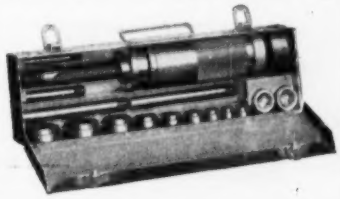
No. 1 Bearing Set above is used to insert or extract bearings from motors or other machines—Capacity ½" to 1 1/16". Set includes two bearing supports for different motor frames, 10 different taps and Fan Motor attachment for bearings less than ½".



No. 2 Bearing Tool Set above is heavy-duty unit for bearings or bushings from 25/64" to 1⅝" inside diameter. Consists of 3 bearing supports, 3 reducing studs and nine heads as shown in metal box.

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INTENSITY: *Banking Area,* 30 Footcandles in Service
Office Area, 35 " " "
Counters, 25 " " "
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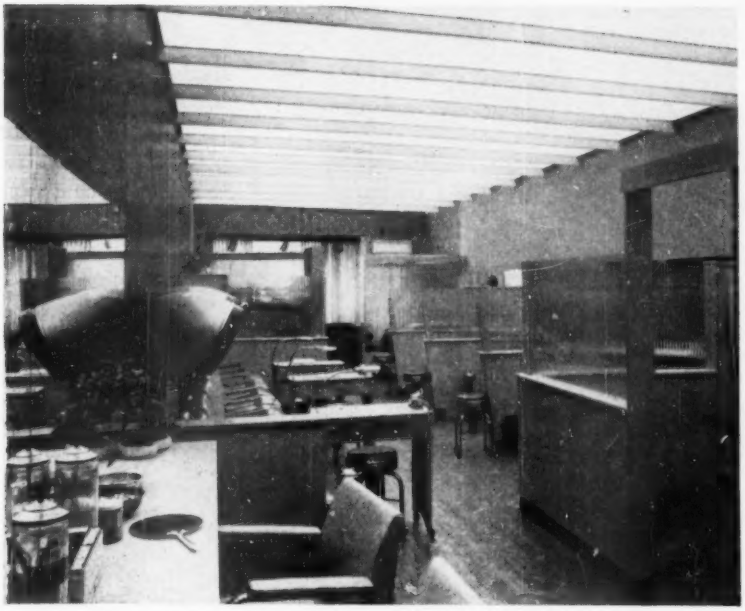


A LUMINOUS CEILING with acoustical baffles provides the main feature of a face-lifting at Arnold Field's Beauty Salon, Chicago, and a more attractive interior. The new lighting eliminates glare, provides 55 footcandles of restful, shadowless illumination, and reduces noise.

Beauty Salon Installs Glareless Lighting

The long existing problem of how to light a beauty salon in a way that will be restful and comfortable for customers, and still provide high intensity shadowless illumination for the employee operators, has at last been solved. The installation of a 55 footcandle intensity lighting system, using a wall-to-wall Acusti-Luminous ceiling, did the trick. The installation was made at the Arnold Field's Beauty Salon, Chicago, and is believed to be the first application of the luminous ceiling in a beauty salon.

The new lighting system consists of sheets of thin, corrugated Lumi-Plastic suspended down 24 inches from the existing true ceiling, on which are mounted continuous rows of fluorescent lamps. The plenum above the plastic ceiling is painted flat white throughout. Acoustical louvers, consisting of perforated steel baffles packed with dense Fibreglas, are attached to the bottom of the I-tracks which support the 36-inch-wide corrugated sheets of plastic. Thus the luminous ceiling has lowered the existing 14-foot high ceiling to 12 feet, provides an even intensity of light throughout the entire salon, creates a warm and cheerful atmosphere, and effectively subdues noise.

Customers at this salon are found to prefer the quieter atmosphere which is more conducive to relaxation, and the beauticians and hair-dressers find they can concentrate on their work better. The entire interior is evenly lighted, and although a practical high level of illumination exists, neither table tops, polished chrome machines and instruments, nor mirrors are a source of annoying, reflecting glare. While the reduction of source and task brightness (and the subsequent reduction of direct and reflected glare) is important in all types of commercial establishments, it deserves primary consideration where customers and employees remain relatively immobile for considerable periods of time.

Primarily, the luminous ceiling is a large area source of diffused light and, while it is important to customers in providing glarefree illumination, employees find that the restful, shadowless light permits them to see every style detail in each coiffure.

The new ceiling, including fluorescent strips, supporting frame-work and acoustical baffles, was supplied by Luminous Ceilings, Inc., of Chicago.

Custom Lighting Layout Sparks Sales

The unique arrangement of lighting equipment in the distinctive **Lad n'** Lassie store of A. R. Mazer, Birmingham, Ala., is credited with attracting an increasing number of customers and pushing sales upward.

Ceiling mounted slimline fluorescent luminaires installed to form a wide V-shape have provided high intensity general lighting with a soft, diffuse and comfortable result. These are supplemented with incandescent spot and flood lamps which accent feature displays. The combined custom lighting layout makes it easier for customers to pick out and appraise merchandise.

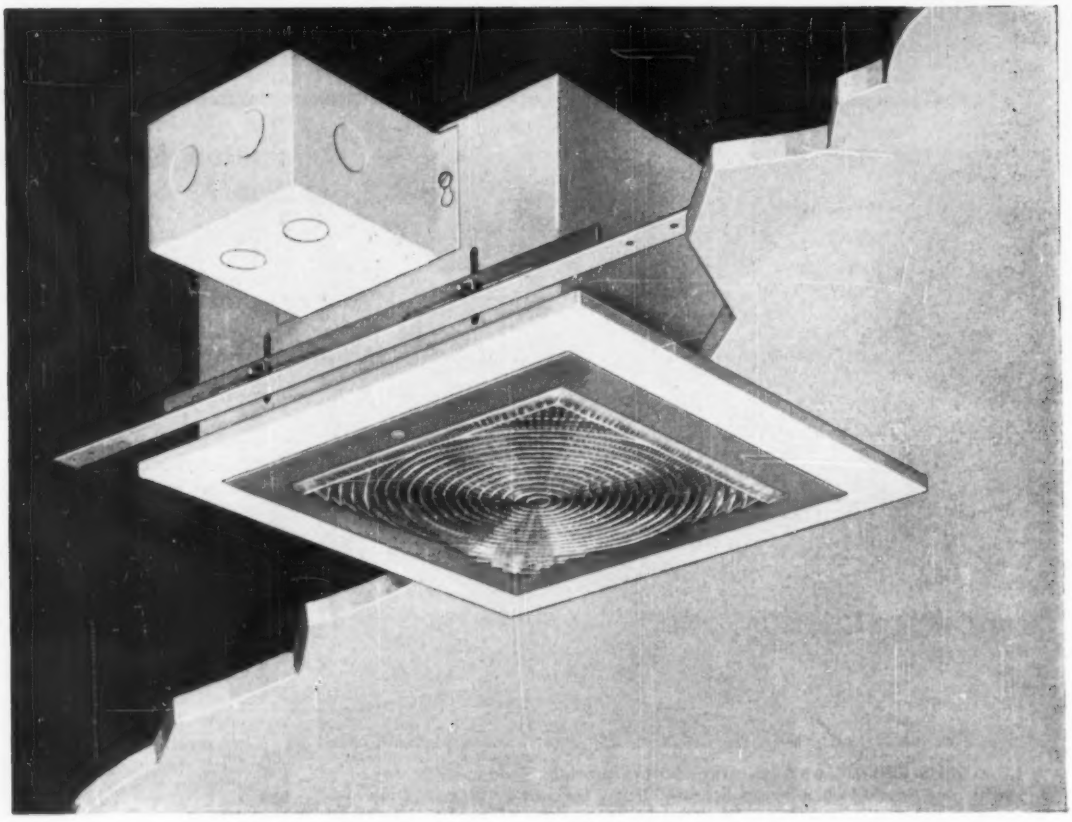
Business has increased about 50% since moving into the new store. Mr. Mazer believes that a large part of the increased business is due to the new lighting system which attracts customers.

The unusual arrangement of the standard design luminaires was installed with the idea of making the store look wider. Mr. Mazer wanted something different than the usual layout of continuous straight rows. To meet this requirement the fluorescent luminaires were ceiling mounted to form a V with a standard right angle opening, having an adjustable spotlight at the apex. This layout provides an even distribution of light throughout the store.

Lighting equipment in the main sales area includes 18 No. SL-9702P-8 luminaires, each with two 96-inch T-12 slimline lamps, 6 No. SL-9702P-4 luminaires, each with two 48-inch T-12 slimline lamps, and 3 No. DP-9702 adjustable spot units, each with one 150-watt PAR-38 side prong base reflector spot lamps. All units are surface installed on the ceiling.

The display window is lighted by 6 No. 6971 surface installed adjustable reflector housings, each equipped with one 150-watt R-40 reflector lamps. The window line of the open glass front is lighted by 5 No. P-6970 pendant units, each equipped with one 150-watt R-40 reflector lamp. Over the doorway is recessed one No. 5878 unit equipped with a 300-watt silvered bowl lamp.

Shelves and wall cases are lighted with built-in fluorescent strips totaling 2200 watts. All of the slimline fluorescent luminaires and incandescent reflector lamp units are Garcy equipment.



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6. Attach to any standard construction:
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B. Bend straps at 90° for joist side attachment.
C. Nail or screw to top of plywood, wood lath, etc.
D. Wire twist through nail hole secures to metal lath.

7. Vertical Slotted Holes provide adjustment for any ceiling thickness from ½" to 2".

8. Captive Floating Nuts slide in Horizontal Slots to provide lateral adjustment between joists.

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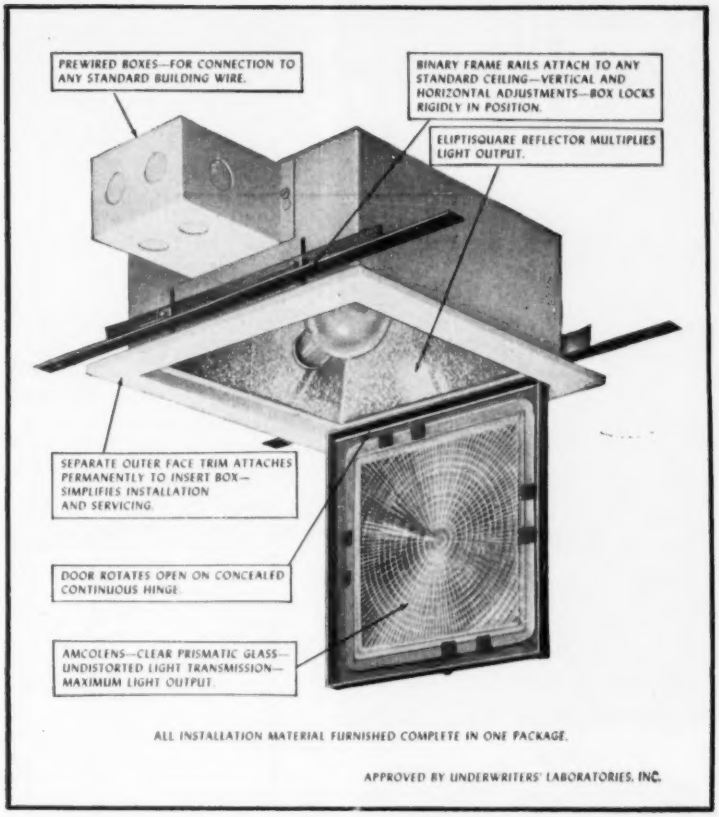
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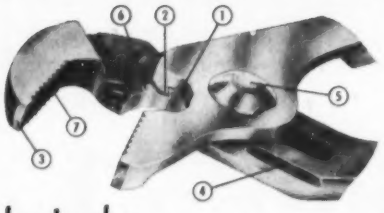

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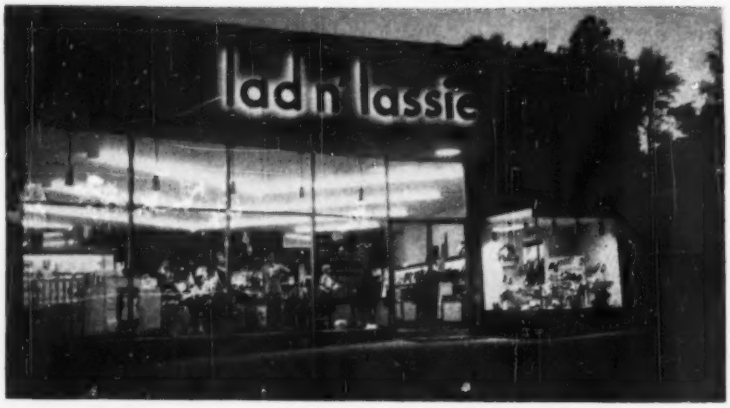
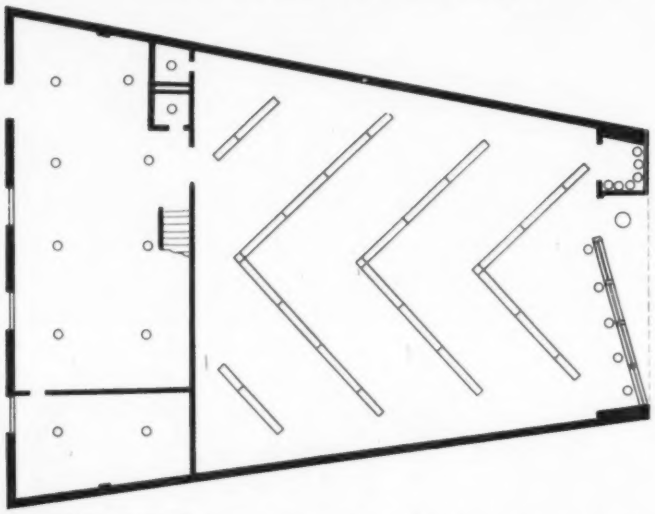


CUSTOM DESIGN lighting layout using standard luminaires provides high level illumination and distinctive appearance to a new Lad n' Lassie store, Birmingham, Ala., and has resulted in 50% increase of sales by the store.



LIGHTING LAYOUT for main floor shows how luminaire arrangement makes store look wider, directs customers to rear of store.

The stock room and office have 22 No. 5228 Bryant units using 150-watt inside frost lamps and 4 No. 5228 similar units, each with one 100-watt inside frost lamp.

The total lighting load is 12,300 watts, consisting of 4470 watts of general lighting, 2200 watts in shelves and wall cases, 1650 watts in the windows, 300 watts over the doorway, and 3700 watts in the stockroom and office.

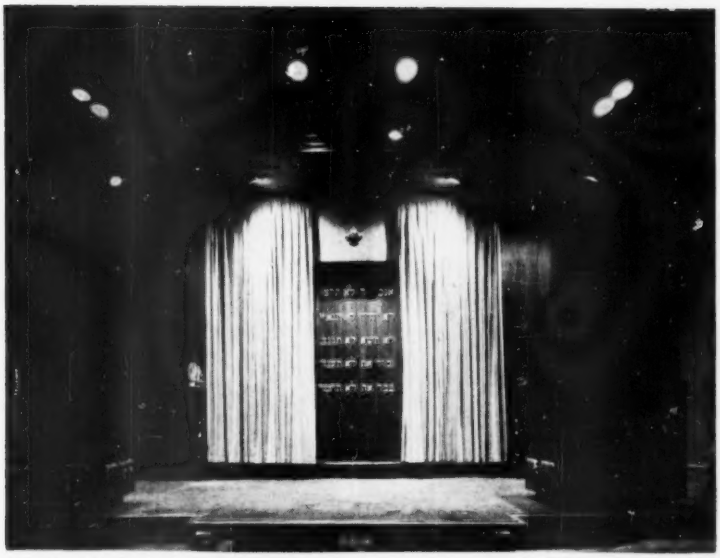
Architect for this store was Martin Lide, who was assisted in the design of the lighting system by E. B. Richey, of Alabama Power Company.

Concealed Units Light Altar

Recessed incandescent fixtures provide an attractive, practical lighting installation for the altar of the Beth Israel Synagogue, Philadelphia, Pa.

Originally, the 10 by 20 foot altar was illuminated by two incandescent ceiling units and an elaborate pendant candelabra on each side of the rostrum. This layout had been found unsatisfactory in several respects. Besides obstructing the view from portions of the auditorium, the candelabras distracted attention from the Ark and the speakers. The lack of adaptability to the requirements of holiday rites was another complaint.

In the new layout six adjustable hi-hats placed along the rear of the platform afford a flexible arrangement which, when focused on the Ark, create a strong interest center at that point. Reading light at the two speaker's stands is provided by two fixed downlights above each location. These have the added benefit of spotlighting the speaker. General lighting is derived from two fixed units at the center of the area. The new in-



ATTENTION is directed to the Ark by focusing 6-adjustable hi-hats on it. The inconspicuous recessed units conform with the austere tone of the altar.

stallation gives an effective, but simple lighting layout in keeping with the conservative atmosphere of the wood paneled altar.

Contractor Jack Adler of Philadelphia used Litecraft fixtures with 150 watt R-40 reflector lamps for the installation.

Lensed Units for Industrial Lobby

The spacious lobby of United Aircraft's Hamilton-Standard propeller plant in Windsor Locks, Connecticut, is a modern creation of Philippine paldao wood panelling, louvex glass doors, travertine floors, stairs and ceiling; aluminum framing strips around windows and display cases, and comfortable chairs for those awaiting appointments with company executives. And, providing illumination for this impressive room, is an installation of recessed Morelite 2-lamp lighting fixtures equipped with Holophane "low intensity" curved lens plates. Lighting of the area varies uniformly from a high of 60 footcandles at the main entrance of the building to 40-fc at the doors leading to interior corridors and offices. Incidental lighting in wall niches is provided by shielded overhead fluorescent lamps mounted without reflectors on standard channels. The installation was designed by Albert Kahn Associated Architects and Engineers of Detroit, Michigan, and was done by the Lord Electric Company of Boston.

LENSED UNITS are mounted singly and in end-to-end arrangements of varying numbers, depending upon beam positions and location of wall offsets, to illuminate this attractive industrial lobby to an intensity varying from 60 to 40 footcandles.

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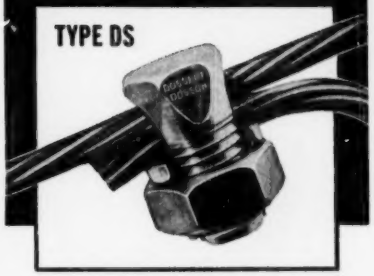

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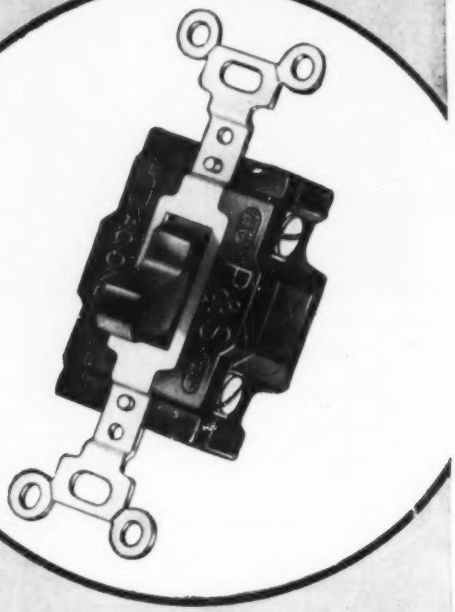

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P&S

In The News

1000 Delegates Attend R.P.I. Industrial Council

"The Electrical Industry: How It Began, How It Operates, What It Does and Where It Is Going"—was the theme of an intensive 2-day Industrial Council held on the campus of Rensselaer Polytechnic Institute, Troy, New York, October 30th and 31st. Attended by approximately a thousand delegates, the registration included some 200 top-level representatives from all branches of the electrical manufacturing industry, over 600 social-science high school teachers from 47 states, school superintendents from 25 different communities, 18 State Commissioners of Education, plus numerous publishers, editors and authors of electrical textbooks and magazines

Sponsored by R. P. I. and supported by 78 industrial organizations serving the electrical field, this Council was presented as an "Experiment in Understanding" with the objective of bringing practical knowledge closer to the classrooms of the nation by "opening the books" of the electrical industry to teachers of secondary students. In this significant new episode in industrial relations, formal talks were made by Ralph J. Cordiner, President of the General Electric Company; Don G. Mitchell, Chairman of the Board, Sylvania Electric Products; Allen B. DuMont, President of the A. B. DuMont Laboratories, and Andrew W. Robertson, Chairman of the Finance Committee, Westinghouse Electric Corporation.

Following each main address, six parallel 2-hour panel discussions were conducted, with 7 or 8 panelists frankly presenting industrial problems and procedures to 150 delegates at each of these sessions, and answering questions concerning all phases of organization, personnel relations, production, merchandising, financing, maintenance and engineering.

In all conferences the calibre of panelists and authority of speakers was unquestionably high, with the roster including such names as W. A. Roberts, president, Allis-Chalmers; Lyle S. Hall, president, Stackpole Carbon; A. H. Johnson, president, National Carbon; Chester H. Lang, v.p., General Electric; Hoyt P. Steele, executive v.p., Benjamin Electric; Arthur A. Berand, president, Ward Leonard; A. D. R. Frazer, president, Rome Cable; J. D. Greensward, director of manufacturing, Allis-Chalmers; Kenneth A. Harmon, president, Wico Electric; W. W. Hicks, president, Wesix Electric Heater; Bruce Wallace, v.p., Otis Elevator; E. Finley Carter, v.p., Sylvania; R. E. Murphy, v.p., I.T.E. Circuit Breaker; Roscoe H. Smith, secretary, Reliance Electric; L. R. Boulware, v.p., General Electric; George A. Grauer, sales manager, Simplex Wire and Cable; Harold N. Felton, v.p., Wagner Electric; James M. Bennan, president, Jefferson Electric; F. W. Kettering, chief engineer, Electromotive Division, General Motors; John H. Thomas, v.p., Owens-Corning Fiberglas; A. F. Metz, president, The Okonite Company; Robert D. Blasier, v.p., Westinghouse; F. F. Loock, president, Allen-Bradley; A. F. Sheldon, president, Kennecott Wire and Cable; L. E. Lighton, v.p., Electric Storage Battery; Barton K. Wickstrum, v.p., Sylvania; Richard S. Hayes, advertising manager, The Okonite Co.; Ross Nichols, executive v.p., Weston Electric Instrument; W. R. Swoish, v.p., Pennsylvania Transformer; Bern Dibner, president, Burndy Engineering; J. R. Bransford, v.p., Western Electric; W. J. Donald, managing director, National Electrical Manufacturers' Association; T. T. Goldsmith, Jr., director of research, Allen B. DuMont Laboratories; Fred H. Pillsbury, president, Century Electric; C. Guy Suits, director of research, General Electric; C. W. Higbee, manager of electrical wire and cable department, United States Rubber; Robert A. Patterson, assistant director, Brookhaven National Laboratories, and many others.

Concluding the final dinner session, a summary panel reviewed the Council's intensive study of the electrical manufacturing industry and its contributions to the economy of our country. Educators and economists joined spokesmen for the industry in this discussion; then Ray Palmer Baker, director of the Council and vice president of Rensselaer, gave the final summation.

It was the consensus of those teachers in attendance that the Council was a powerful new medium for industrial understanding, showing educators how industrial democracy is functioning in the United States and, through these teachers, helping to bring reality closer to the classroom. Industrial representatives present were also agreed as to the Council's unique contribution. Panelists were pleased that the sessions were not "one-way-streets" and found that the serious discussion periods were both challenging and stimulating.

RALPH J. CORDINER, President, General Electric Company.

DON G. MITCHELL, Chairman of the Board, Sylvania Electric Products.

ANDREW W. ROBERTSON, Chairman of Finance Committee, Westinghouse Electric Corporation.

J. P. Reynolds Joins Editorial Staff

A new assistant editor, John P. Reynolds, has been added to the editorial staff of *Electrical Construction and Maintenance*.

Jack brings an extensive background in electrical contracting to his new position. He worked intermittently with his father's firm, the A. S. Reynolds Electric Co., Brooklyn, N. Y., throughout his school years and, since graduating, has been employed there successively as mechanic, estimator and engineer, superintendent, and vice-president. He represented his company at NECA meetings and participated in labor contract negotiations.

JOHN P. REYNOLDS

His particular interests are the development of more accurate estimating practices and the recognition by the building industry of the importance of better electrical planning.

Jack holds a B.A. degree in Literature from Rutgers University, New Brunswick, N. J. He has studied Electrical Engineering for three years at the Polytechnic Institute of Brooklyn, N. Y. During World War II he served in the Pacific with the Signal Corps and is presently an officer in the Infantry Reserve.

Although an ardent golfer, Jack says his most active pastime is repairing his Long Island home; the Reynolds have three children.

Florida Contractors Elect Officers

The Florida Association of Electrical Contractors at its meeting in Tampa elected V. B. Burkhardt of West Palm Beach association president. At the same time Axel O. Orbery of Orlando was named vice-president.

Directors elected included Rudy Beache, Jacksonville; J. H. Baroca, Pensacola; W. A. Brinson, St. Petersburg; Gene Duffy, Ft. Lauderdale; Dick Boyette, Ft. Myers; Dick Palmer, West Palm Beach; F. S. Shinn, Lakeland; W. A. Stewart, Bradenton, and Cliff Whitmore, Miami.

Clark and Winne Receive McGraw Awards

Bonnell W. Clark, former Westinghouse vice president who headed the Electrical Equipment Section of the National Production Authority, and Harry A. Winne, vice president, General Electric Company, received James H. McGraw Award medals. These were presented by R. Stafford Edwards, acting for the Committee of Awards, at a luncheon meeting of the National Electrical Manufacturers Association in Atlantic City on November 11.

Mr. Clark received the Medal for Cooperation in recognition of his outstanding accomplishments in the great task of mobilizing the resources of the electrical industry to the service of the nation.

The panel of judges who recommended Mr. Clark included Graham Claytor, American Gas and Electric Service Corp., R. A. Goeller, Hatzel & Buehler, Inc.; C. McKew Parr, Parr Electric Co.; A. F. Warren, Monowatt Corp. and W. T. Stuart, *Electrical Construction and Maintenance*.

Mr. Winne received the Manufacturers Medal in recognition of his outstanding industrial statesmanship contributing to the advancement of the electrical manufacturing industry in the fields of engineering and nuclear research.

The judges were J. M. Bennan, Jefferson Electric Co.; W. S. Edsall, Chase-Shawmut Co.; B. C. Neece, Landers, Frary and Clark; Hoyt P. Steele, Benjamin Electric Manufacturing Co. and W. T. Stuart.

Chicago EME Expands, Now Has Two Chapters

The Electrical Maintenance Engineers of Chicago, a division of The Electrical Association, has been growing steadily throughout the past five years. This year, with membership pushing the 600 mark, it crashed the restraining bonds of its original organizational setup. To more adequately serve its membership, the EME split up into two sections—a Southern Chapter for members in the heavy south Chicago and Gary, Indiana, industrial areas; and a Central Chapter for members in the rapidly expanding western suburban industrial centers.

This move was sanctioned by general membership approval of revised bylaws. Now each chapter operates more or less independently under the direction of an Executive Committee with chairman and vice chairman; develops its own program; has its own meeting place for monthly dinner-sessions. Virgil E. Otto, Electric Association staff member, acts as secretary-treasurer of both groups.

Responsibility for overall EME operation is vested in a Board of Governors composed of eight executive committee members from each chapter. At the fall organizational meeting of this new executive group, T. J. Peters of the United States Steel Company, South Chicago, was elected chairman. H. W. Parthemer, International Harvester Co., Chicago, is vice chairman.

Complete organizational stability is assured by having Board officers act in a dual capacity. Board chairman Peters is chairman of the Southern Chapter; has as his vice chairman, E. J. Fitzgerald of the E. I. duPont deNemours & Co., Inc., East Chicago, Indiana. Board vice chairman Parthemer heads the Central Chapter with Paul Patrick, Bowman Dairy Co., Chicago, as vice chairman.

The new organizational plan provides a growth flexibility the EME has not previously had. The door is open to the formation of other Chap-

LIGHTING COMPETITION WINNER Eugene G. Lombard (right), Wauwatosa, Wis., is congratulated by E. H. Herzberg, executive manager, Electrical Contractors Association, Milwaukee Chapter, NECA. Contractor Lombard entered his lighting installation at the Michael M. Sedler's Jewelry Store, Wauwatosa, in the National Lighting Competition for Electrical Contractors sponsored by Electrical Construction & Maintenance magazine and copped an honorable mention award. Middle west editor, August Eckel, presented the certificate to Mr. Lombard at a meeting of the Milwaukee electrical contractor group.

TALL TEXAN, L. G. White, president of L. G. White Electric Co., Dallas, Texas, is the firm guiding hand which directs and integrates the company's electrical construction activities.

ters in the Chicago area as may be required by added membership and expanded activities. Even now, the blueprint of a third chapter is being drawn. According to C. C. Simpson, managing director of the Electric Association, this will probably be in the Lake County area to serve the industrial concentration in the north and northwest suburbs.

NISA News

The next meeting of the Southwestern Chapter is scheduled for Corpus Christi in March, the day to be determined later. Program chairman is V. A. Bailey, Jr. The chapter is conducting a membership drive with a $25 prize to the member signing up the largest number of new members. At the present time three men, Paul Bush, John Loyd and Cleo Lewis, are tied for first place.

• • • •

Midwestern Chapter met Sept. 19th in the Hotel Henford, Mason City, Iowa, with 18 members and four guests attending. After a morning business meeting and a luncheon, courtesy of H. O. Hale, the afternoon session was devoted to discussion of Fusetrons, proposed NISA regional changes, and a talk by F. R. Hippler, Insulation & Wires, Inc., the new Milar insulation. The chapter passed a resolution disapproving of a proposed change in regional boundaries affecting their area. The banquet in the evening was sponsored by H. A. Holden, Inc.

The next meeting will be held in Davenport, Iowa, in April, 1954, on a day to be determined.

• • • •

New officers of the Cincinnati Chapter elected October 7th were president, Clarence W. McEntyre, Almac Electric Service; vice-president, Dean H.

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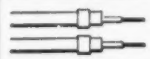

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• • • •

Regular meeting of the New York Metropolitan Chapter—first since summer vacation was held September 17th in the lounge of the Hotel Shelburne. Sixty-eight, including four guests, representing 43 firms saw "The Making of Brass," a Chase Brass Copper Co. film. The rest of the meeting was devoted to Chapter business.

Ladies Night on Thursday evening, October 29th, of the New York Metropolitan Chapter of the National Industrial Service Association held at the Park Sheraton Hotel brought out 175 members, wives, and their guests.

The October meeting of Quaker City Chapter brought out a goodly number of out-of-towners including Roland Stolzenbach and E. T. Brueckmann from Baltimore, Stanley Lewars of Lebanon and Paul Secrest from Trenton. Fifty members were on hand. Ralph Kufen talked on "Calculating Polyphase Motor Windings From A Bare Coil."

Quaker City Chapter's Regular Get-Together was held at Beck's On The Boulevard on November 11th.

• • • •

New England Chapter held its regular meeting at the Hotel Bradford on October 8th. The meeting was called to order by President Ed. Kolhonen. Secretary's report was read and accepted. Myer Friedkin of the Metropolitan Chapter reported on the New York Ladies Day. The treasurer's report was read and accepted. Vice-president Arthur Glines reported on the progress of the program committee. Chairman Jack Reddington reported the progress of the Northeastern Conference committee. Al Elson reported on National Affairs and on the NISA News. Myer Friedkin added his international views of the news. Frank Sweeney, chairman of the membership committee, reported the progress of that committee.

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Edgar H. Borde, managing director, Engineering Ltd., Trinidad, British West Indies, recently visited the following New York NISA shops: Premier Electric and Engineering Co., Consolidated Electric Motor Co., Electric Enterprise Co., The Maintenance Co., S. J. O'Brien Co. and Schneider Electric Motor Co.

• • • •

Central District Chapter held its meeting on November 10th at the Tower Club in Chicago. Dinner was served at 6:30 P.M.

Ideal Electric & Mfg. Co. gave an illustrated presentation of their completely new designed motors and generators (from one to two thousand horsepower) designed with an eye toward ease of maintenance, construction and repair. Also of particular interest was the company's pressure equalizer connection on bearings which breaks the vacuum on the inboard side of bearing housing and prevents oil leakage due to pressure differential. D. H. Ruark, assistant sales manager, came from the Mansfield Plant to present this feature.

AWARD CERTIFICATE is received by Miss Agnes Whitfield, bookkeeper, McGee Electric Co., Clearwater, Florida, for her honorable mention award in the floodlighting classification of EC&M's Lighting Competition for Electrical Contractors. Her entry covered an underwater lighting installation at The Five Palms, Clearwater Beach, Florida. Award was presented by William B. Shenk (right), of Florida Power Corp., St. Petersburg, Fla. on behalf of EC&M at a joint meeting of the Florida West Coast Adequate Wiring Bureau and the St. Petersburg Electrical Contractors Association on October 12 at the Glades Hotel, Redington Beach, Florida. Thomas McGee, owner of McGee Electric (left) looks on approvingly.

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Indianapolis Chapter met October 16th to hear Owen J. Neighbours, attorney and labor relations expert, and President M. O. Ross of Butler University. President William M. Hogue also attended the meeting.

• • • •

William Humberg, editor of Volt Age since last year, has resigned to accept the post of managing editor of Farm Equipment Retailing. Both magazines are published in St. Louis. He has since been succeeded by Harvey Gray, formerly editor of the publication of Weirton (W. Va.) Steel Co.

• • • •

The women's committee for the 1954 Detroit Convention held its first meeting October 8th at the Hotel Statler, Detroit, in the Woodward Room. Mrs. Charles H. Howard is chairman of the group.

From Walter J. Prise, The Maintenance Company, New York City.

DATES AHEAD

National Rural Electric Cooperative Assn.—National convention, Miami, Florida, Jan. 11-14, 1954.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 8-12.

Plant Maintenance & Engineering Show—Exhibits International Amphitheatre, Conferences Hotel Conrad Hilton, Chicago, Ill., January 25-28.

Power and Communication Contractors Association — Ninth Annual convention, Edgewater Beach Hotel, Chicago, Ill., March 8-11.

Illuminating Engineering Society — Regional Conferences: Southern — Roosevelt Hotel, New Orleans, La., April 8-9; Southwestern—Rice Hotel, Houston, Texas, April 11-13; Inter-Mountain — Denver, Colo., April 15-16; South Pacific Coast—Museum of Art, San Francisco, April 19-20; Pacific Northwest—Benjamin Franklin Hotel, Seattle, Wash., April 22-23; Canadian—King Edward Hotel, Toronto, Ont., Canada, April 28-30; Great Lakes—Sheraton-Cadillac Hotel, Detroit, Mich., May 3-4; Midwestern — Jefferson Hotel, St. Louis, Mo., June 17-19.

American Society of Tool Engineers' Industrial Exposition — Convention Center, Philadelphia, Pa., April 26-30.

National Fire Protection Association—58th annual meeting, Statler Hotel, Washington, D. C., May 17-21.

National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., Week of June 6.

Among the Manufacturers

Headquarters Announcement

General Electric Co., Schenectady, N. Y.—Maynard W. Johnson, manager, Distribution Transformer plant in Oakland, Calif.; Lisle D. Hodell, manager, General Purpose Component Motor Dept., Fort Wayne, Ind.; Ab Martin, manager, Hermetic Motor Dept., Fort Wayne; Carl W. Moeller, manager, Appliance Motor Dept., DeKalb, Ill.; Jack J. Clarkson, manager, Specialty Component Motor Dept., Fort Wayne.

Westinghouse Electric Corp., Pittsburgh, Pa.—M. H. Hobbs, manager, Switchgear Div., East Pittsburgh, Pa.; Harry W. Tenney, administrative assistant to vice president, Elevator Division, Jersey City, N. J.; James A. Babcock, plant manager, Watthour Meter Plant, Raleigh, N. C.; Robert H. Wagner, general application engineering manager, Elevator Division, Jersey City.

Automatic Transportation Co., Chicago, Ill.—George A. Hinckley, sales manager.

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ROYAL ELECTRIC CO., INC. PAWTUCKET, R. I.

New York, N. Y.—Dr. O. G. Haywood, Jr., manager of engineering planning.

Day-Brite Lighting, Inc., St. Louis, Mo.—Carl L. Powell, director of sales training.

General Electric Co., Home Heating and Cooling Dept., Bloomfield, N. J. —Lawrence H. Hirschbach, manager of builder sales; R. F. Hertel, manager of manufacturing: C. M. toeLaer, manager of commercial engineering; T. N. Willcox, application engineer.

Tensolite Insulated Wire Co., Inc., Tarrytown, N. J.—J. J. Dowling, vice president.

General Electric Co., Carboloy Co., Detroit, Mich.—Frank B. Nuelle, manager, engineering administration section.

Elwell-Parker Electric Co., Cleveland, Ohio—William H. Campbell, treasurer and assistant secretary.

William Miller Instruments, Inc., Pasadena, Calif.—John Hogg, sales engineer.

General Electric Co., Electronics Div., Syracuse, N. Y. — James H. Sweeney, manager of marketing, James E. Keister, manager of engineering, and Theodore E. Jamro, manager of manufacturing, Germanium Product Unit of Commercial Equipment Dept.

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.—Theodore E. Mueller, chairman of the board of directors; J. A. Grazier, president.

Kuhlman Electric Co., Bay City, Mich.—Joel H. Watkins, sales manager, transformers and allied products.

General Electric Co., Major Appliance Div., Louisville, Ky.—C. Vernon Phillips, manager of dept. store sales.

United States Steel Corp., American Steel & Wire Div., Cleveland, Ohio—Edwin E. Caspell, general superintendent of the New Haven, Conn., and Trenton, N. J. plants.

Newman Industries (America) Inc., New York, N. Y.—F. Pat Greene, general sales manager.

Robertshaw-Fulton Corp., Fielden Instrument Div., Philadelphia, Pa.—Lee E. Cuckler, manager, engineering department.

General Electric Co., Distribution Assemblies Dept., Plainville, Conn.—R. C. Wilson, manager of engineering; T. D. MacLafferty, manager of marketing; Charles K. Skinner, manager of manufacturing; R. J. Blair, manager of finance.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has assumed operation of the Buda Company, Harvey, Ill., with Ralph K. Mangan as president and general manager.

Thompson Products, Inc., Cleveland, Ohio, announces purchase of Bell Sound Systems, Columbus, Ohio.

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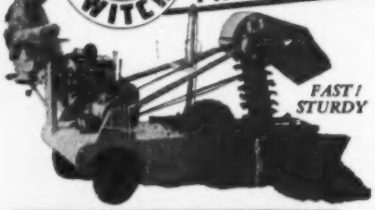

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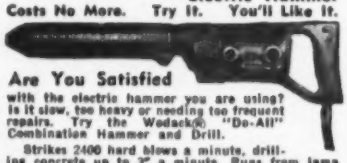

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NEW ENGLAND

Rhode Island Insulated Wire Company, Inc.: Normal Brill, New England sales manager, Cranston, R. I.

United States Steel Corp., American Steel & Wire Div.: Stephen B. Metcalfe, assistant district manager of operations, Worcester District.

Remington Corp., Air Conditioning Div.: Louis F. White, New England sales manager, Belmont, Mass.

Line Material Co.: James A. Hartshorn, apparatus engineer, Eastern Division, office in Revere, Mass.

MIDDLE ATLANTIC

Westinghouse Electric Corp.: E. W. Loomis, vice president, Atlantic Region, headquarters in Philadelphia, Pa.; T. P. Jones, manager, Philadelphia District.

Remington Corp., Air Conditioning Div.: Fred A. Weber, district sales manager, Metropolitan N. Y. and N. J.

SOUTH ATLANTIC

Westinghouse Electric Corp.: J. W. Magee, manager Chesapeake District, office in Baltimore, Md.

Remington Corp., Air Conditioning Div.: John C. Crites, service representative, southeastern United States.

EAST CENTRAL

Graybar Electric Co.: Harry Bryson, manager; C. W. Kraich, operating manager, Springfield, Illinois.

BullDog Electric Products Co.; J. Donald Akers, district mgr., Detroit.

General Electric Co., Major Appliance Division: Lloyd G. Hertzler, manager, Great Lakes region, office in Appliance Park, Louisville, Ky.

Feedrail Corporation: H. J. Werner, representative for Southern Ohio territory, office in Dayton, Ohio.

United States Steel Corp., American Steel & Wire Div.: Edward R. Cassidy, Cleveland traffic manager.

Litecraft Mfg. Corp.: Joseph A. Tills, Mid-West sales mgr., Chicago.

WEST CENTRAL

Graybar Electric Co.: E. L. Preston, manager, and H. L. Coldwell, operating manager, Abilene, Texas, branch.

WEST

Remington Corp., Air Conditioning Div.: W. H. Dennison, West Coast regional manager, Palo Alto, Calif.

Manitowac Equipment Works: George W. Clausen, district sales manager, Calif., Ariz., and Nev.

Pacific Transformers, Inc.: William Herron, West Coast sales engineer.

General Transformer Co.: Win W. Tompkins, representative in northern California and Reno, Nevada.

SUGGESTED GRAPHIC WIRING SYMBOLS

[FROM PAGE 91]

parallel industry progress, and the inclusion, where advisable, of more expressive graphic symbols. Already a committee is working to establish an adequate set of standard symbols for signaling systems.

You, who read this article and are interested in symbol revisions, are invited to submit your comments and suggestions. Only through the wholehearted cooperation of the entire industry can an acceptable, workable standard be established.

Until a revised national standard is available, Chicago will use its newly developed set of symbols. This "local standard" may well be the basis of re-establishing the universal language of symbols in the electrical construction field.

The Technical Advisory Committee of Mechanical Construction Industries of Greater Chicago included the Chicago Association of Consulting Engineers; Electrical Contractors Association of City of Chicago; Heating, Piping and Air Conditioning Contractors, Chicago Association; Plumbing Contractors Association of Chicago and Ventilating and Air Conditioning Contractors Association of Chicago.

The Industry Task Group for revision of ASA Standard Z32.9 (Y32.9) Graphical Electrical Symbols for Architectural Plans consisted of Chairman A. C. McWilliams, chairman, Codes and Standards Committee, Electrical Contractors Association of City of Chicago, Inc., Chicago, Ill.; and Secretary E. R. Cornish, director of research and education, National Electrical Contractors Association, Washington, D. C. Members were National Electrical Contractors Association, A. C. McWilliams, Chicago, Ill., O. F. Wadleigh, Indianapolis, Ind., A. G. Ofenstein, Detroit, Mich.; American Institute of Architects, H. R. Sleeper, New York, N. Y.; American Institute of Electrical Engineers, J. J. Anderson, New York, N. Y.; American Standards Association, H. E. Farrer, New York, N. Y.; American Society of Mechanical Engineers, D. M. Shackelford, New York, N. Y.; National Electrical Manufacturers Association, Signaling Section, H. P. Blake, Springfield, Mass.; and Specialty Wiring Material Manufacturers (member to be appointed on recommendation of respective companies).

ELECTRICAL PLANNING FOR SHOPPING CENTERS

[FROM PAGE 88]

spread that might exist in the system.

By using capacitors in the motor circuits, the amount of magnetizing current which must be carried by the feeder cables is reduced, as the capacitors will provide the magnetizing current needed by the motor, and the current flowing in the feeder cables can be completely utilized to the fullest extent for doing useful work.

Fig. 6 shows a capacitor installation in a department store in Cleveland which improved power factor and reduced billing costs.

Parking Area Lighting

Average figures for shopping centers throughout the United States show that the total center occupies an area of approximately 50 acres, and that 43% of this total area is utilized as a parking facility for shopping center patrons. Naturally the lighting of these parking facilities is of the utmost importance, for shopping center patrons do the greatest portion of their buying during the evening shopping hours. The patrons' ability to find their automobiles upon leaving the shopping center is certainly a desirable feature; especially in a vast sea of parked automobiles.

Parking facilities should be lighted by means of floodlights mounted in clusters on strategically located steel towers throughout the parking area, or these areas can be lighted by modern street lighting luminaires mounted on attractive modern street lighting standards which blend with the architectural plan of the shopping center. Fig. 5 shows a well-designed lighting arrangement at a Baltimore Department Store parking lot. Fluorescent street lighting luminaires, which are the newest development in the field, can also be used to provide a maximum of illumination with standard fluorescent fixtures that are readily accessible for maintenance work.

In many shopping centers the problem of controlling traffic flow is of the utmost importance and a completely new traffic signal control system should be erected and installed. In many cases shopping centers are located on a main highway and depending on local conditions the cost of the installation of these controlling devices must be partially borne by the shopping center owners. Careful consideration should be given to the type of equipment for this job both from the reliability and functional standpoints.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

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$1.20 per line, minimum 3 lines. To figure advance pay-ment count 5 average words as a line.
Position Wanted and Individual Selling Opportunity Wanted undisplayed rate is one-half of above rate, payable in advance.
Box Numbers in care of our New York, Chicago & San Francisco offices count as one additional line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Equipment Wanted or For Sale Advertisements acceptable only in Displayed Style.
Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $11.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

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E. C. M.

WORLD'S LARGEST INVENTORY

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MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.
ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

TELEPHONE INTERCOM SYSTEM
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Complete with 33 phones made by Stromberg Carlson & Graybar in very good condition. Sell cheap.
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"A Unique Tool of the Trade"
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if you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertiser wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

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Electric Wire MANUFACTURER
Pittsburgh Sales Agent having warehouse facilities and sales organization interested in representing manufacturer in Western Pennsylvania and West Virginia.
RA-9906, Electrical Construction & Maintenance
520 N. Michigan Ave., Chicago 11, Ill.

ELECTRIC WIRE IN STOCK
Underground, Overhead, Welding, Asbestos, Telephone, Elevator, High-voltage Cables, Plus More.
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FOR SALE
SURPLUS UNUSED ELECTRICAL CABLE
6457' 4/0 RHL Str. 600 V.
1470' 3/0 RR 600 volt Str.
2085' 3/0 Motor lead wire str. 600 volt
580' 350 MCM 1/C VCB5kV
7365' #6RC V. Str. type Buna-S
NEKOOSA EDWARDS PAPER COMPANY
Port Edwards, Wis.

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- for every industrial and power application
- odd lengths—long and short—reasonably priced
- largest stock in Midwest
- varnished cambric—leaded—neoprene

Let us quote on requirements—send your inquiries

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QUICK . . . from stock
We'll also buy your Surplus
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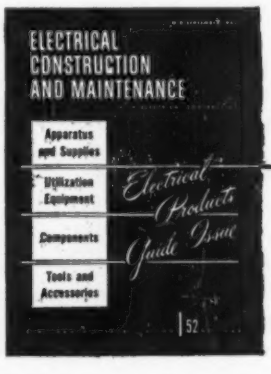


• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the Index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

It's New! It's Simple! It's the Most Complete

See XO CIRCUIT BREAKER LOAD CENTER LINE!

1 to 32 Circuits

Only six devices form the basic XO line in general purpose enclosures.

Main Breakers

For the first time! Load centers with main breakers for 1 phase, 3 wire or 3 phase, 4 wire devices.

1 Phase, 3 Wire 3 Phase, 4 Wire

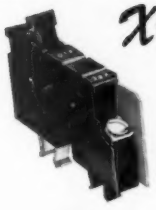
To meet modern trends in distribution. Both raintight and general purpose.

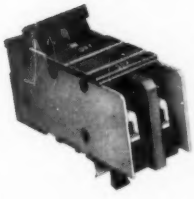
Raintight

All enclosures are Underwriters' approved. Available with or without provision for the popular interchangeable hubs.

"Plus" Applications

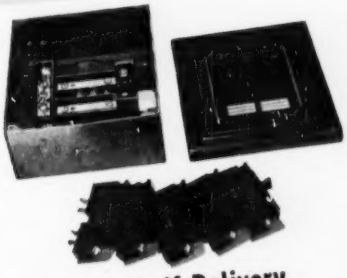
The XO solves specific water heater, switched neutral and other split bus problems—in many cases with standard components.





XO Plug-in Units have ALL the Features...

1. **Quick-Make, Quick-Break** operation at no extra cost.
2. **Ambient Compensation** ends nuisance tripping. No extra cost.
3. **Thermal-Magnetic**—complete two-way protection against both moderate and heavy overloads.
4. **Non-Interchangeable feature** prevents higher capacity 30, 40, 50 ampere sizes from being substituted for 15 and 20 ampere breakers. Discourages tampering.



Off-the-Shelf Delivery

Just 3 components simplify selling and stocking. Box with interior, cover, and plug-in breakers. Breakers conveniently packed in individual boxes and multi-packed in cartons. All the sales features—highest quality, no cost premium, immediate delivery.

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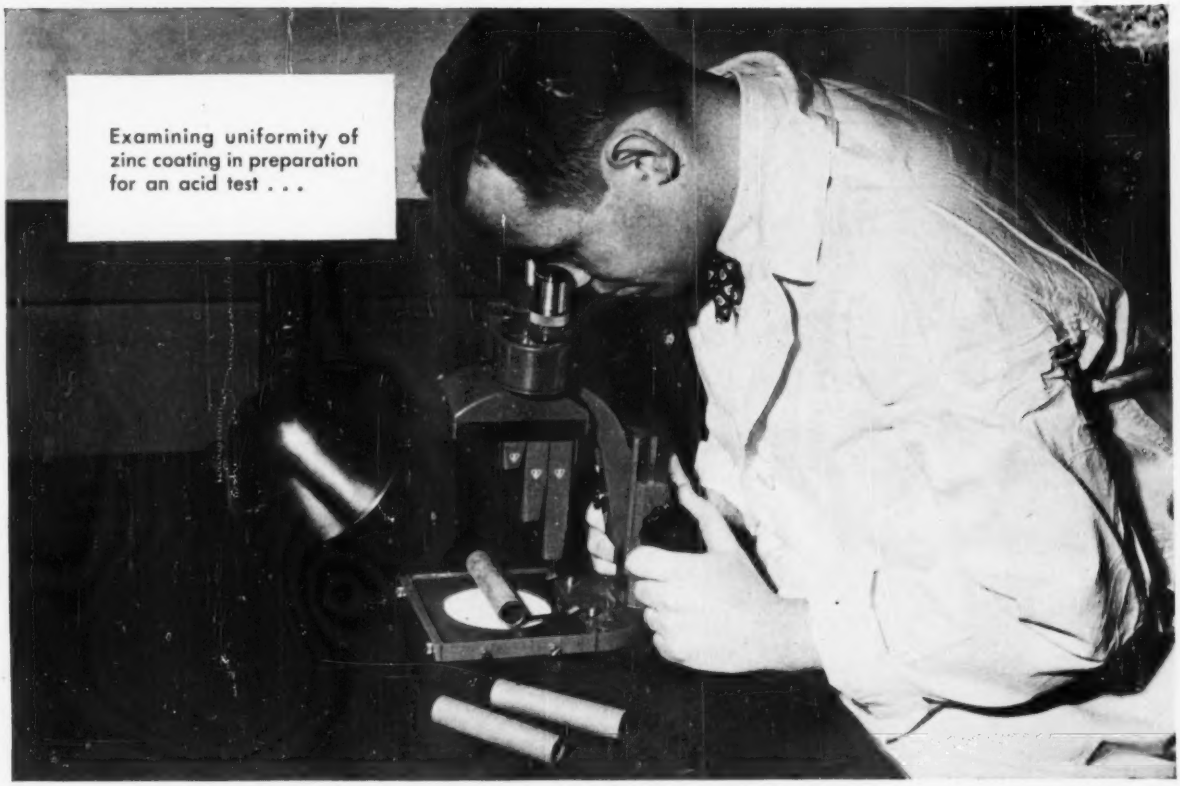
SQUARE D COMPANY

1903 · 50 YEARS OF DESIGN LEADERSHIP · 1953



One of the many tests that helped prove that...

New G-E WHITE increases service life with improved corrosion resistance

The new G-E WHITE conduit was tested, along with samples of other types of conduit, for:

- 42 days in ammonium hydroxide.
- 150 hours in sulphuric acid.
- 150 hours in hydrochloric acid.
- 1000 hours in a 20% solution of salt spray at 95° F.
- 42 days in 100% humidity at 105° F.
- 37 days to determine healing effect of zinc coating.

These tests proved that the corrosion resistance of new G-E WHITE conduit was unsurpassed by any other type tested.

The new G-E WHITE conduit meets FEDERAL SPECIFICATION WW-C-581b (May 4, 1951)

LABORATORY TESTS

The new G-E WHITE rigid steel conduit has been thoroughly tested in General Electric laboratories. It has withstood salt spray, heat, and humidity tests without corroding. When exposed to the corrosive fumes found in industrial atmospheres, it has shown unsurpassed corrosion resistance. (See data at left.)

SERVICE TESTS

The new G-E WHITE is zinc galvanized by the metallizing process. The superior corrosion resistance of this process has been proved by many years of use on ship hulls, water tanks, railway overpasses, and other metal structures exposed to corrosive conditions.

USER REPORTS

Contractors report that the new G-E WHITE conduit bends easier, saws easier, and threads easier than old-style conduit, because metallizing eliminates those processes which cause most conduit to harden. Wires pull more easily too, because the new inside coating contains a special antifriction compound. For more information on this new conduit that simplifies installation and stands up so well against corrosion, see your G-E Construction Materials distributor or write Section C38A-1218, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

GENERAL ELECTRIC